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Part 6 - TEMPORARY TRAFFIC CONTROL

600 GENERAL

600-1 Introduction

The information provided in this chapter is intended to supplement **OMUTCD Part 6** by presenting **ODOT** policies, standards, guidelines, practices and procedures concerning the design and application of various types of temporary traffic control. Examples of situations which require temporary traffic control include highway construction and maintenance work, utility work, special events (e.g., tournaments and festivals) and incidents (e.g., traffic accidents and chemical spills).

In addition to typical methods for maintaining traffic through temporary traffic control zones, this chapter also provides suggestions for when detours may be used and guidelines for the preparation of plans. It does not address every conceivable condition. Each situation is unique; therefore, the temporary traffic control should consider the individual characteristics of that particular situation.

One function of this chapter is to serve as a guide for the designer in developing strategies to maintain traffic during construction activity, and in preparing a set of maintenance of traffic plans for incorporation into a set of highway construction plans. ***Tables 697-1a through 697-1f*** present a review of the pros and cons of various temporary traffic control options.

Information on policies, guidelines and standards related to temporary traffic control devices and their use are located in the front part of this chapter. For example, ***Section 602*** addresses the various elements of a temporary traffic control zone, ***Section 604*** addresses flagger control, ***Section 605*** discusses the individual devices, and typical applications are addressed in ***Section 607***. Information specifically related to design, construction and maintenance functions is located in the later sections ***(Sections 640 through 660)***.

600-2 Construction Projects

Section 150 addresses the general application of **ODOT** standards, specifications and **SCDs** to construction projects, while this chapter provides additional detail information.

Coordination with other projects is necessary in order to minimize the inconvenience to road users ***(see Section 640-17)***. This may require communication among several government jurisdictions, various offices within **ODOT** and several contractors.

Projects should be scheduled to avoid routing a detour ***(Section 602-6)*** through another construction site. See ***Section 640-16*** for information regarding work on detours and alternate routes. ***Section 640-17*** addresses signing for adjacent projects.

600-3 Force Account (ODOT Operations) Work

Districts performing force account work must comply with the requirements in the **OMUTCD** and this Manual. It is recommended that the **Districts** also follow the provisions in applicable **SCDs** and **CMS** sections. However, it should be recognized that the information in the **CMS** and **SCDs** does not necessarily provide the only method to achieve a given objective.

600-4 Public Communication

Communicating the details of highway improvement projects is desirable and necessary. The traveling

public, businesses, schools and communities are all impacted by a construction project. In general, road users find it difficult to accept the disruption of travel caused by work activities; therefore, maintaining good public relations is very important, especially on major projects.

Public meetings, news releases and media alerts, among other communication tools, should be used to communicate to the public and to maintain good public relations. Involvement of the news media and local authorities in publicizing the existence of, and the reasons for, work activities can be of great assistance in keeping the public well informed.

Guidance on public communication is provided in the **Project Communication Manual** included in ***Section 1311*** (as Appendix F of **Policy 516-003(P)**).

600-5 High- vs. Low-Volume Highways

Part 5 addresses traffic controls for the category of roads known as Low-Volume Roads (LVR). Generally, **ODOT**-maintained highways do not fall with the LVR category defined in ***Part 5***.

However, traffic volume is a useful criteria when addressing levels of traffic control appropriate in various situations. Therefore, the terms “low-volume” and “high-volume” are often used. For purposes of this chapter, unless defined otherwise for a specific situation, “high-volume” describes a highway with an ADT greater than 4,000, and a “low-volume” street or highway has an ADT of 4,000 or less.

601 FUNDAMENTAL PRINCIPLES

601-1 General

The control of road users through a temporary traffic control zone is an essential part of highway construction, utility work, maintenance operations and incident management. However, the safety of those road users and workers in temporary traffic control zones shall also be an integral and high-priority element of every project from planning through design and construction. Maintenance and utility work should also be planned and conducted with the safety of drivers, bicyclists, pedestrians and workers considered at all times.

The objective of temporary traffic control in general is to provide for the safe and expeditious movement of traffic through work zones and incident areas by doing the following:

1. Alerting the road user;

2. Telling the road user what to do;

3. Guiding the road user through or around the site; and

4. Protecting the worker.

OMUTCD Section 6B.01 outlines various principles and procedures that experience has shown tend to enhance the safety of road users and workers in work zones and incident areas.

601-2 Work Zones on Interstates and Other Freeways

As much as safely possible, methods for traffic control should produce the least possible effect on traffic operations by minimizing the frequency or time of hindrance to normal traffic flow.

In an attempt to minimize delay to road users on Interstate and other freeway projects, **ODOT** has developed **Policy 516-003(P), Traffic Management in Work Zones Interstate and Other Freeways *(see Section 1311)***. This policy establishes standards for acceptable traffic queuing. Predicted queue lengths resulting from decreased capacity of the highway at a work site on Interstate and other freeways shall not exceed the standards set by this policy.

On the basis of this policy, Permitted Lane Closure Maps (PLCMs) have been established for each **District**. **OTE** will consolidate this information into a statewide system of maps which will be available from the **OTE** web page. The maps and related scheduling information shall be reviewed periodically by the **Districts** and updated as needed. Use of the PLCMs in the design process is described in ***Section 630-4***.

The concepts presented in **Policy 516-003(P)** should also be considered for application on non-freeway projects.

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602 TEMPORARY TRAFFIC CONTROL ELEMENTS

602-1 General

This section addresses various basic elements of temporary traffic control, e.g., Temporary Traffic Control Plans (also known as Maintenance of Traffic Plans), definitions of the components of a traffic control zone, tapers and one-lane, two-way traffic control.

602-2 Temporary Traffic Control Plans

A Temporary Traffic Control (or Maintenance of Traffic) Plan describes temporary traffic control measures to be used for facilitating the road users through a work zone. These plans play a vital role in providing a continuity of safe and efficient traffic flow when a work zone, incident or other event, temporarily disrupts the normal flow of traffic.

Depending on what's needed, these plans may range in scope from very detailed to simply a reference to a manual figure, a typical drawing or a sketch in the contract document.

602-3 Temporary Traffic Control Zones

As noted in ***Section 1301-3***, a temporary traffic control zone is 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.

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 rotating/strobe lights on a vehicle to the END ROAD WORK sign or the last temporary traffic control device.

An incident area is an area of a highway where temporary traffic controls are imposed by authorized officials in response to a road user incident, natural disaster or a special event.

602-4 Components of Temporary Traffic Control Zones

602-4.1 General

The temporary traffic control zone established for a particular work activity or incident begins with the first advance warning device and ends at the point beyond the work area where traffic is no longer affected. As noted in **OMUTCD Section 6C.03**, most zones include the following elements: advance warning area, transition area, activity area and termination area. These four areas are described in **OMUTCD Sections 6C.04 through 6C.07 and Figure 6C-1**. Some of this information is repeated here in ***Sections 602-4.2 through 602-4.5, and Figure 698-1***.

602-4.2 Advance Warning Area

An advance warning area is the section of highway where road users are informed about the upcoming work zone or incident area. The advance warning area may vary from a single sign or flashing amber light on a vehicle to a series of signs starting a mile or more in advance of the transition area.

The advance warning area should be long enough to give road users adequate time to respond to conditions. For most situations, the length of the advance warning area should be:

1. One-half to 1 mile (0.8 to 1.6 kilometer) for freeways or expressways.

2. One-quarter mile (0.4 kilometer) for rural highways.

3. At least one block for urban streets.

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.

602-4.3 Transition Area

When a lane or shoulder closure is used, or when traffic is shifted, a transition area shall be used to channel traffic from the normal travel lanes into the path required to move around the work area. The transition area should be obvious to road users, with the correct path clearly marked.

Transition areas usually involve strategic use of tapers ***(see Section 602-5)***, which because of their importance are discussed separately.

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

602-4.4 Activity Area

602-4.4.1 General

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

When work occurs on a high-volume, highly congested facility, an incident management vehicle storage space may be provided so that emergency vehicles (for example, tow trucks) can respond quickly to road user incidents. If used, this storage area should not extend into any portion of the buffer space.

602-4.4.2 Work Space

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

Work spaces may remain in fixed locations or may move as work progresses.

There may be several work spaces within the project limits (even separated by several miles); however, each work space should be adequately signed to inform road users and reduce confusion.

602-4.4.3 Traffic Space

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

602-4.4.4 Buffer Space

As shown in **OMUTCD Figures 6C-1 and 6C-2** and ***Figure 698-1***, 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. The activity area may contain one or more lateral or longitudinal buffer spaces.

The buffer space should be free of work activity, equipment, material, work or shadow vehicles, workers, and the workers' personal vehicles.

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

Typically, the buffer space is formed as a traffic island and defined by channelizing devices. When a formidable device, such as a shadow vehicle or an arrow panel, is placed in such an island, only the area in front of (upstream of) the device functions as a buffer.

A longer buffer space should be used when high speed highways or high truck volumes are involved, or when the work area is located around a curve, over a hillcrest or on a downgrade.

The lateral buffer space may be used to separate the traffic space from the work space, or from 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. The width of a lateral buffer space should be determined by engineering judgment.

602-4.5 Termination Area

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 space to the END ROAD WORK signs, if posted.

602-5 Tapers

602-5.1 General

Tapers are an important element of a temporary traffic control zone. They may be used in both the transition and termination areas. As noted in **OMUTCD Section 6C.08**, whenever tapers are to be used in close proximity to interchange ramps, crossroads, curves, or other influencing factors, it may be desirable to adjust the length of the tapers.

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

The criteria for determining taper length (L) is shown in **OMUTCD Table 6C-2** and should be the minimum used. The minimum desirable taper lengths apply to roadway conditions of relatively flat grades and straight alignment. Longer tapers are not necessarily better than shorter tapers (particularly in urban areas characterized by short block lengths, driveways, etc.). Extended tapers tend to encourage sluggish operation and to encourage drivers to delay lane changes unnecessarily. The real test of taper length involves observation of driver performance after traffic control plans are put into effect.

The maximum space between devices in a taper should approximate the distance in feet of the speed in miles per hour (i.e., a 55 miles per hour speed road should normally have devices spaced about 55 feet apart). It is desirable to provide spacing which is less that the maximum allowable. The desired spacing is shown in **SCD MT-95.30, Table II** and in **SCD MT-95.31, Table I**.

602-5.2 Merging Taper

A merging taper requires the longest distances because drivers are required to merge with an

adjacent lane of traffic at the prevailing speed. The taper should be long enough to enable merging drivers to adjust their speeds and merge into a single lane before the end of the transition. An example of a merging taper is shown in **OMUTCD Figure 6C-2**.

602-5.3 Shifting Taper

A shifting taper is used when merging is not required, but a lateral shift is needed. Approximately one-half L has been found to be adequate at speeds less than 50 miles per hour. Where speeds are 50 miles per hour or greater, then the distance L should be used, except the taper should never be less than 300 feet (90 meters). Where more space is available, it may be beneficial to use longer distances. Guidance for changes in alignment may also be accomplished by using horizontal curves designed for normal highway speeds. An example of a shifting taper is shown in **OMUTCD Figure 6C-2**.

602-5.4 Shoulder Taper

A shoulder taper may be beneficial on high-speed roadways with improved shoulders that may be mistaken for driving lanes (when work is occurring in the shoulder area). If used, shoulder tapers approaching the activity area should have a length of about one-third L. If a shoulder is used as a travel lane either through practice or during a temporary traffic activity, a normal merging or shifting taper should be used. An example of a shoulder taper is presented in **OMUTCD Figure 6C-2**.

602-5.5 Downstream (Ending) Taper

The downstream (ending) taper may be useful in termination areas to provide a visual cue to the driver that access is available to the original lane or path that was closed. When used, a downstream taper should have a minimum length of about 100 feet (30 meters) per lane, with devices spaced about 20 feet (6 meters) apart. An example of a downstream taper is shown in **OMUTCD Figure 6C-2**.

602-5.6 One-Lane, Two-Way Taper

The one-lane, two-way traffic 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. Traffic should be controlled by a flagger or a temporary traffic signal (if sight distance is limited), or a STOP or YIELD sign. A short taper having a maximum length of 100 feet (30 meters), with channelizing devices at approximately 20-foot (6 meter) spacings, should be used to guide traffic into the one-way section. **OMUTCD Figures 6H-10 and 6H-46** illustrate one-lane, two-way traffic control situations using flaggers.

602-5.7 Lane Width Transition

Often it is necessary to decrease the lane width in a work zone. The rate of taper required for modifying a lane width is as in ***Section 602-5.3*** above except that W (width of offset in feet (meters)) is equal to the change in lane width.

602-5.8 Multiple Tapers

Occasionally it is necessary to close more than a single lane of pavement in order to perform the necessary work on the highway. This may be accomplished by closing several travel lanes or by shifting lanes or by a combination of both. Any of these conditions will creates a need for more than a single taper. Multiple tapers shall be separated by tangent sections. For example, if the number of open lanes in one direction of a multilane highway is to be reduced by two, then it will

be necessary to provide two merge tapers, separated by a tangent section of length 2L as shown in **OMUTCD Figure 6H-37** (where L is the minimum permitted taper length of the associated tapers as indicated in **OMUTCD Table 6C-2**). If there is a reduction of one lane and a shift of the remaining open lanes, then one merge taper and one shift taper shall be provided. The merge taper and the shift taper shall be separated by a tangent section of length ½ L as shown in **OMUTCD Figure 6H-32**.

602-6 Detours, Alternate Routes and Diversions

A detour is a temporary rerouting of road users onto an existing highway in order to prohibit through traffic within the work zone. As noted in **OMUTCD Section 6G.09,** detours should be clearly signed over their entire length so that road users can easily use existing highways to return to the original highway. Normally, detours on the state highway system are provided by the **District**. See **OMUTCD Section 6F.50** for related signing, as well as ***Sections 605-7 and 605-8***. **OMUTCD Figures 6H-8, 6H-9, 6H-19 and 6H-20** provide examples of detours.

An alternate route is similar to a detour except that the work zone remains open to through traffic. The road user is able to choose ones preference. The road user may either remain on ones intended route and travel through the work zone, or one can follow the signed alternate route.

A diversion is a temporary rerouting of road users onto a temporary highway or alignment placed around the work space, e.g., median crossovers, runarounds or lane shifts. **OMUTCD Figure 6H-7** is an example of a diversion.

Consideration should be given to other projects in the area, traffic patterns, traffic volumes, types of vehicles, local activities and special events when planning detour installations or diversions. This would require that adequate attention be given to proper scheduling of projects in order to avoid simultaneous construction or maintenance activity on parallel highways. Proper scheduling may require coordination between **Districts** or even within various offices in a single **District** ***(see Section 640.16)***.

Two **Standard Operating Procedures (SOPs)** maintained by the **Office of Highway Management** should be consulted when detours are required:

1. **OPS-103, Detours** is to be used to determine whether work on an existing highway, be it by contract or by **ODOT** force account, will require the closing of the highway with provision for detours, temporary roads and temporary runarounds, or whether traffic will be maintained through all or portions of the construction project, and to establish reporting procedures.

2. **OPS-104, Maintenance & Repair of Local Roads and Streets Used as: Official Detours, Designated Local Detour Routes, or Haul Roads**, establishes the method for designating a local detour. A local detour is a route, other than the official detour, that is anticipated to be most used by traffic bypassing the closed portion of the highway. Only one local detour shall be designated for each official detour. These documents also discuss the need to coordinate with the local officials and financing procedures.

602-7 One-Lane, Two-Way Traffic Control

602-7.1 General

As noted in **OMUTCD Section 6C.10**, where traffic in both directions must, for a limited distance, use a single lane, “provision should be made for alternate one-way movement through the constricted section.” Some means of coordinating movements at each end shall be used to avoid head-on conflicts and to minimize delays. Control points at each end should be chosen to permit easy passing of opposing lines of vehicles. At a "spot" obstruction, however, such as an isolated pavement patch on roadways with lower speeds and adequate sight distance, the movement may

be self-regulating. Alternate one-way traffic control may be accomplished as appropriate by flagger control **(OMUTCD Section 6C.11)**, a flag-carrying or official car **(OMUTCD Section 6C.12)**, a pilot car **(OMUTCD Section 6C.13)**, traffic signals **(OMUTCD Section 6C.14)**, or by using stop or yield control. This section provides additional information regarding flagger control, the use of traffic signal and the use of STOP or YIELD signs (see **OMUTCD Section 6E.01** for flagger qualifications).

602-7.2 Flagger Method

This method of one-lane, two-way traffic control is described in general in **OMUTCD 6C.11**.

When a single flagger is used, the flagger should be stationed on the shoulder opposite the obstruction 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 may 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. The use of radios may also be desirable even though visual contact is possible.

602-7.3 Temporary Traffic Signal Method

As noted, traffic signals may be used to control vehicular traffic movements in temporary traffic control zones. They should be considered for half-width bridge reconstruction on low- to moderate-volume highways. When used, traffic signals shall be installed at each approach to the one-lane section, and drivers shall be appraised of their presence by means of the Signal Ahead sign preceded by appropriate Construction Warning Signs **(see OMUTCD Figure 6H-12)**.

602-7.4 Stop or Yield Control Method

STOP or YIELD signs may be used to control traffic on low-volume roads at a one-lane, two-way work zone when drivers are able to see the other end of the one-lane, two-way operation and have sufficient visibility of approaching vehicles. 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. The approach to the side that is not closed must be visible (for a distance equal to the safe-passing sight distance for that approach) to the driver who must yield or stop **(see OMUTCD Figure 6H-11)**.

602-8 Work Vehicles

The general term “work vehicle” refers to any of the vehicles used in performance of the work (i.e., those used to do the work, haul material, equipment or workers and to provide traffic control). The term is also used to refer specifically to one of the two types of vehicles generally used in temporary traffic control, i.e., “work vehicles” and “shadow vehicles”.

When differentiating between the types of vehicles in the zone, “work vehicle” refers to those vehicles used to do the work or haul material, equipment, or workers.

A “shadow vehicle” is used for traffic control. It may be used within the traffic control zone to provide advance warning for traffic, or to guide traffic into the proper lane by the use of signs or a flashing arrow panel. The shadow truck should be positioned a sufficient distance in advance of the workers or equipment being protected so that there will be sufficient distance, but not so much so that errant vehicles will travel around the shadow truck and strike the protected workers and/or equipment.

During working hours, the shadow vehicle shall display a flashing, rotating or oscillating amber light

visible to all directions of traffic for at least one-quarter mile (0.4 kilometer). For additional protection, the shadow vehicle may be equipped with a truck-mounted attenuator (TMA) ***(see Section 605-15.3)***.

A shadow vehicle may also be placed, unoccupied, within the traffic control zone immediately in advance of the work space in a stationary operation. When a shadow vehicle is used in this way, a separate space should be provided for it. This space should be long enough to accommodate the vehicle itself, plus an open space in front of the vehicle to provide for the “roll ahead” which may occur following impact. This area is usually delineated by channelizing devices.

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603 PEDESTRIAN AND WORKER SAFETY

603-1 General

In addition to creating vehicular restrictions, work zones and incident areas may also cause conflicts for pedestrian traffic and workers. Pedestrians and workers are exposed to hazardous conditions from both the work activity and the traffic. This section addresses the need to provide for pedestrian and worker safety in temporary traffic control zones. Also see **OMUTCD Chapter 6D**.

603-2 Pedestrian Considerations

Where pedestrian traffic is present, pedestrian safety and needs must be addressed. See **OMUTCD Section 6D.01**.

There are three threshold considerations in planning for pedestrian safety in temporary traffic control zones on highways and streets:

1. Pedestrians should not be led into conflicts with work vehicles, equipment, or operations.

2. Pedestrians should not be led into conflicts with vehicles moving through or around the work zone or incident area.

3. Pedestrians should be provided with a safe, convenient travel path that replicates as nearly as possible the most desirable characteristics of sidewalks or footpaths.

In accommodating the needs of pedestrians, it should always be remembered that the range of pedestrians that can be expected is very wide, including the blind, the hearing impaired, and those with walking handicaps. All pedestrians need protection from potential injury and a smooth, clearly delineated travel path.

Therefore, every effort should be made to separate pedestrian movement from both work site activity and vehicular traffic. Whenever possible, signing should be used to direct pedestrians to safe street crossings in advance of an encounter with a temporary traffic control zone. Signs should be placed at intersections so that pedestrians, particularly in high-traffic-volume urban and suburban areas, are not confronted with mid-block activity areas that will induce them to skirt the temporary traffic control zone or make a mid-block crossing. It must be recognized that pedestrians will only infrequently retrace their steps to make a safe crossing. Consequently, ample advance notification of sidewalk closures is critically important. Refer to **OMUTCD Figures 6H-28 and 6H-29** for typical traffic control device usage and techniques for pedestrian movement through work areas. Traffic control for a pedestrian detour is also presented in **SCDs MT-110.10, 110.20 and 110.30**.

Cuts into work areas across pedestrian walkways should be kept to a minimum, because they often create unacceptable changes in grade and rough or muddy terrain. Pedestrians cannot be expected to traverse these areas willingly. They will tend to avoid the cuts by attempting non-intersection crossings.

The engineer in charge of traffic control for temporary traffic control zones should provide both a sense of security and safety for pedestrians walking past work sites and consistent, unambiguous channelization to maintain foot traffic along the desired travel paths. The activity area should be regularly inspected so that effective pedestrian temporary traffic control is maintained.

603-3 Worker Considerations

Equally as important as the safety of road users traveling through the work zone or incident area is the safety of workers **(see OMUTCD Section 6D.02)**. Temporary traffic control zones present temporary and constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the personnel on or near the roadway.

Maintaining the temporary traffic control zones with road user flow inhibited as little as possible, and using temporary traffic control devices that get the road user's attention and provide positive direction are of particular importance.

The following are key elements of traffic control management that should be considered in any procedure for assuring worker safety:

1. Training - All workers should be trained in how to work next to motor vehicle traffic in a way that minimizes their vulnerability. Workers having specific temporary traffic control responsibilities should be trained in temporary traffic control techniques, device usage and placement.

2. Worker Clothing - Workers close to the motor vehicle traveled way should wear bright, highly-visible clothing **(see OMUTCD Section 6E.02)**.

3. Temporary Traffic Barriers - Temporary traffic barriers should be placed along the work space depending on such factors as lateral clearance of workers from adjacent traffic, speed of traffic, duration of operations, time of day and volume of traffic.

4. Speed Reduction - Reducing the speed of motor vehicle traffic, mainly through regulatory speed zoning, funneling, use of law enforcement officials, lane reduction or flaggers may be considered.

5. Shadow Vehicle - In the case of mobile and constantly moving operations, such as pothole patching and striping operations, a shadow vehicle, equipped with appropriate lights, Warning Signs and/or a rear-mounted impact attenuator may be used to protect the workers from impacts by errant vehicles.

6. Road Closure - If alternate routes are available to handle road users, the road may be closed temporarily. This may facilitate quicker project completion and thus further reduce worker vulnerability.

7. Police Use - In highly vulnerable work situations, particularly those of relatively short duration, police units may be stationed to heighten the awareness of passing motor vehicle traffic and to improve safety through the temporary traffic control zone.

8. Lighting - For nighttime work, the work zone and approaches may be lighted.

9. Special Devices - Judicious use of special warning and control devices may be helpful for certain difficult work area situations. These include rumble strips, changeable message signs, hazard identification beacons, flags and warning lights. Intrusion warning devices may be used to alert workers to the approach of errant vehicles. However, misuse or overuse of special devices or techniques may lessen their effectiveness.

10. Public Information - Improved driver performance may be realized through a well-prepared and complete public relations effort that covers the nature of the work, etc. ***(see Section 600-4)***.

604 FLAGGER CONTROL

604-1 General

This section provides information supplementing that presented in **OMUTCD Chapter 6E** regarding the use of flaggers to provide temporary traffic control.

604-2 Qualifications for Flaggers

Because flaggers are responsible for public safety and make the greatest number of public contacts of all highway workers, they should have the minimum qualifications described in **OMUTCD Section 6E.01**.

604-3 High-Visibility Clothing

OMUTCD Section 6E.02 addresses the requirements for high-visibility clothing for flaggers. The same high-visibility clothing is recommended for law enforcement officers (LEOs) when they provide traffic control.

604-4 Hand-Signaling Devices

OMUTCD Section 6E.03 addresses the basic requirements for hand-signaling devices used to control road users through temporary traffic control zones. As noted in that section, the STOP/SLOW sign paddle is the primary hand-signaling device.

In addition to the requirement for flag use described in **OMUTCD Section 6E.03**, flag use should be limited to emergency situations; however, they may also be appropriate at some intersections and at low-speed and/or low-volume locations which can best be controlled by a single flagger.

604-5 Hand-Signaling Procedures

STOP/SLOW sign paddle and flag use are illustrated in **OMUTCD Figure 6E-1**. The signaling procedures used with the paddle or the flag shall be as described in **OMUTCD Section 6E.04.**

ATSSA publishes a pocket-sized **Flagger Handbook** which may be used for easy reference on flagging procedures ***(Section 695-3)***.

604-6 Flagger Stations

Except as noted below for a single flagger at a “spot” location, flagger stations shall be located far enough ahead of the work space, so that approaching traffic has sufficient distance to stop before entering the work space **(see OMUTCD Section 6E.05)**. **OMUTCD Table 6E-1** provides guidelines for determining the distance of the flagger station in advance of the work space. These distances may be increased for downgrades and other conditions that affect stopping distance.

As noted in **OMUTCD Section 6E.05**, the flagger should stand either on the shoulder adjacent to the traffic being controlled or in the barricaded lane. A flagger should only stand in the lane being used by moving road users after the road users have stopped. The flagger should be clearly visible to the first approaching road user at all times. The flagger should also be visible to other road users. The flagger should be stationed sufficiently in advance of the workers to warn them (for example, with audible warning devices such as horns, whistles, etc.) of approaching danger by out-of-control vehicles. The flagger should stand alone, never permitting a group of workers to congregate around the flagger station.

At “spot” lane closures where adequate sight distance is available for the safe handling of traffic, the use of one flagger may be sufficient **(see OMUTCD Figure 6H-18** and accompanying notes**)**. At such a "spot" obstruction, a position may have to be taken on the shoulder opposite the barricaded section to operate effectively.

Flagger stations should be preceded by proper advance Warning Signs. Under certain geometric and traffic situations, more than one flagger station may be required for each direction of traffic. At night, flagger stations should be illuminated.

605 TEMPORARY TRAFFIC CONTROL ZONE DEVICES

605-1 General

The design and application of temporary traffic control devices used in temporary traffic control zones should consider the needs of all road users. All traffic control devices used on street and highway construction, maintenance, utility, or incident management operations shall conform to the applicable provisions of the **OMUTCD**.

OMUTCD Chapter 6F addresses the design and application of traffic control devices for use in temporary traffic control zones. Additional information on the standards and guidelines for the design and use of these devices is included in this part of the **TEM**.

The traffic control devices discussed herein include signs, pavement markings, raised pavement markers, channelizing devices, lighting devices, beacons, warning lights, traffic signals, and other devices used to regulate, warn or guide traffic.

Section 607 provides additional information on the use of these devices in typical applications, ***Section 640*** provides additional design and plan preparation information, ***Section 650*** addresses construction issues, ***Section 660*** addresses maintenance issues, and ***Section 670*** addresses various other considerations.

Crashworthiness and crash testing information on temporary traffic control devices are found in **AASHTO's Roadside Design Guide (RDG)** ***(see Section 193-12)***. Additional materials and hardware information related to temporary traffic control zone devices is addressed in ***Section 620***.

As noted in **OMUTCD Section 6F.01**, where the color orange is required, fluorescent red-orange or fluorescent yellow-orange colors may also be used. The fluorescent version of orange provides higher conspicuousness than standard orange, especially during twilight.

605-2 General Characteristics of Signs

605-2.1 General

Temporary traffic control zone signs convey both general and specific messages by means of words or symbols and have the same three categories as all road user signs: regulatory, warning and guide described in **OMUTCD Part 2**.

The most commonly used work zone signs are discussed in detail in **OMUTCD Chapter 6F** and in ***Sections 605-2 through 605-10***. Illustrations of temporary traffic control signs that are discussed in this Manual, but not shown in the **OMUTCD** are provided in ***Figures 698-3a and 698-3b***.

The **OMUTCD** and this chapter also provide examples of common applications of these signs. **ODOT** standards for application of work zone signing on construction projects are provided in the **SCDs** and this Manual, and material requirements are addressed in ***Section 620*** and **CMS 614**. Also see ***Part 2*** of this Manual for further signing information.

When standard orange flags or flashing warning lights are used in conjunction with signs, they shall not block the sign face.

605-2.2 Design

The colors for Regulatory Signs shall follow the standards in **OMUTCD Chapter 2B**. Warning Signs in temporary traffic control zones shall have a black legend on an orange background, except for the Railroad Advance Warning Sign, which shall have a black message and border on a yellow background, and except for signs that are permitted in **OMUTCD Chapter 2C** to have yellow or fluorescent yellow-green backgrounds. Colors for Guide Signs shall follow the standards in **OMUTCD Chapter 2D**, except for Guide Signs noted in ***Sections 605-7 and 605-8***.

As noted in **OMUTCD Section 6F.02**, existing yellow or fluorescent yellow-green Warning Signs already in place within temporary traffic control zones may remain in use when applicable. Color for other signs shall generally follow the standard for all highway signs.

605-2.3 Placement

Signs should be placed on the right side of the roadway unless otherwise specified in the **OMUTCD** or this Manual. **OMUTCD Section 6F.03 and Figure 6F-1** provide guidelines for height and lateral clearance of temporary post-mounted signs. **SCDs MT-105.10 and 105.11** also address temporary sign supports. For increased visibility, a 7 foot (2.1 meter) mounting height may be used in rural areas.

As noted in **OMUTCD Section 6F.03**, signs mounted on portable supports may be placed within the roadway itself. Signs may also be mounted on or above barricades. Signs mounted on barricades and barricade/sign combinations shall be crashworthy.

Neither portable nor permanent sign supports should be located on sidewalks, bicycle lanes, or areas designated for pedestrian or bicycle traffic.

Methods of mounting signs other than on posts are illustrated in **OMUTCD Figure 6F-2**. Except as noted below for mobile operations, signs mounted on portable supports should not be used for a duration of more than three days. Signs mounted on Type III barricades should not cover more than fifty percent of the top two rails or thirty-three percent of the total area of the three rails.

For mobile operations, a sign may be mounted on a work vehicle, a shadow vehicle, or a trailer stationed in advance of the temporary traffic control zone or moving along with it. The work vehicle, the shadow vehicle, or the trailer may have an impact attenuator.

See ***Section 221-4*** for information about erecting signs on or near utility poles.

605-3 Regulatory Signs

605-3.1 General

Regulatory Signs in temporary traffic control zones are addressed in **OMUTCD Chapter 6F**. This section will be used to provide additional information about Regulatory Signs discussed in the **OMUTCD** if needed. Information about Regulatory Signs used in temporary traffic control zones that are not currently addressed in the **OMUTCD** are discussed in ***Section 605-4***.

If a temporary traffic control zone requires regulatory measures different from those existing, the existing permanent regulatory devices shall be removed or covered and superseded by the appropriate temporary Regulatory Signs. **OMUTCD Sections 2B.11and 2B.16** and ***Section 1210*** should be consulted before temporary traffic control zone regulatory speed limits are established.

605-3.2 ROAD CLOSED Sign (R11-2)

This sign is addressed in **OMUTCD Section 6F.08**. The words BRIDGE OUT (or BRIDGE CLOSED) may be substituted for ROAD (STREET) CLOSED where applicable.

The sign should be erected at or near the center of the roadway on or above a Type III barricade that closes the roadway. The sign shall not be used where traffic is maintained, or where the actual closing is some distance beyond this sign.

605-3.3 Weight Limit Signs (R12-1, R12-H1, R12-2, R12-H2, R12-4, R12-H4, R12-5, R12-H5)

These signs are addressed in **OMUTCD Sections 2B.43 and 6F.10**. When weight restrictions are imposed, a marked detour shall be provided for vehicles weighing more than the posted limit. A supplemental distance plaque (R16-H13) shall be provided with the appropriate weight limit sign at the point where the detour is provided.

605-4 Special Regulatory Signs

605-4.1 General

This section is intended to address signs developed for use on **ODOT**-maintained highways that are not currently addressed in the **OMUTCD**. There may be a need for various Regulatory Signs that are not in the **OMUTCD**. They may eventually be incorporated into the **OMUTCD**; however, if their use is limited they may not be incorporated into that manual. Special Regulatory Signs should conform to the general requirements of color, shape and alphabet size and series. The sign message should be brief, legible and clear.

605-4.2 Work Zone Speed Limit Sign (R2-1)

Speed limit reduction through work zones shall be provided as per ***Section 640-18.2.*** Where the speed limit reduction is applied, signing shall be as indicated in ***Section 642-24*** **(Plan Note 642-24).**

605-4.3 Work Zone Increased Penalties Sign (R11-H5a)

ORC Section 5501.27(A)(1) requires that the **Director of Transportation** "adopt rules governing the posting of signs advising motorists that increased penalties apply for certain traffic violations on streets or highways in a construction zone."

ORC Section 5501.27(A)(2) requires that the Director also adopt "rules governing the posting of signs to be used pursuant to section 2903.081 of the Revised Code giving notice to motorists of the prohibitions set forth in sections 2903.06 and 2903.08 of the Revised Code regarding the death of or injury to any person in a construction zone as a proximate result of a reckless operation offense or speeding offense."

ORC Section 4511.98, states that "The director of transportation, board of county commissioners, or board of township trustees shall cause signs to be erected advising motorists that increased penalties apply for certain traffic violations occurring on streets or highways in a construction zone. The increased penalties shall be effective only when signs are erected in accordance with the guidelines and design specifications established by the director under section 5501.27 of the Revised Code, and when a violation occurs during hours of actual work within the construction zone."

Chapter 5501:2-10 of the Ohio Administrative Code (OAC) documents the guidelines

established by the **Director** pursuant to **ORC Section 5501.27**. For convenience, those guidelines are also presented in this section. **Administrative Code Section 5501:2-10-02** requires that each agency adopt procedures pertaining to requiring a contractor, work crew, or utility to erect, maintain, and remove signs, in conformance with the these guidelines.

Work Zone Increased Penalty signs (R11-H5a) shall be used in construction zones on multi-lane divided highways where the work is expected to last thirty days or more, if the planned work length is at least 0.50 miles (0.80 kilometer), and if the construction zone is stationary. The signs may also be erected in any other construction zone at the discretion of the **Director**.

The signs may be erected for construction zones located on other highways meeting the foregoing requirements (i.e., thirty days, at least 0.50 miles (0.80 kilometer) in length, and stationary work) if required by the agency's procedures adopted under **5501:2-10-02(C)** or at the discretion of the **Director**.

The signs should be dual-mounted on a directional roadway of a divided highway, but need only be mounted on the right side of an undivided roadway or ramp.

The first R11-H5a sign shall be placed between the ROAD WORK AHEAD or other similar Warning Sign and the next sign in the sequence (but following the Reduced Speed Ahead sign where provided). Additional signs are required for long construction zones or where ramps or through streets junction within the construction project work limits. Signs shall be erected on each entrance ramp, near intersections of through roads to advise entering or turning traffic, and at least once every two miles through the construction work limits.

The signs shall be furnished, erected, maintained in good condition and/or replaced as necessary and subsequently removed by the entity which erects the traffic controls within the project. Signs shall be mounted at the appropriate offsets and elevations as prescribed by the **OMUTCD**. They shall be mounted on supports meeting current safety criteria.

Where construction activity affects only one directional roadway of a divided highway with a barrier or wide median, signs shall not be erected for traffic on the opposing directional roadway or ramp.

Signs shall be covered or removed when a construction zone is discontinued for a period of thirty days or more. Additionally the agency may require signs to be covered or removed for a specific shorter period.

Where a series of ROAD WORK AHEAD signs are provided, with supplemental distance plates, on **ODOT**-maintained highways, the R-11-H5a sign shall be placed following the final ROAD WORK AHEAD sign immediately preceding the location at which construction activity begins.

Erection of R11-H5a signs in a temporary traffic control zone on **ODOT**-maintained highways can be initiated in three different ways, depending on the nature of the construction:

1. For **ODOT** construction projects, a determination will be made during the design phase as to whether the proposed construction activities will comply with requirements for the signs. When signs are required, they should be included in the construction contract plans for furnishing, erection, maintenance, covering, removal, etc. by the contractor. Prior to commencement of pertinent construction activities, the project engineer will assure that the assumptions concerning construction conditions are still valid and that the signing still applies in the manner originally determined.

   The project engineer shall assure that signs are erected, maintained in good condition, covered, uncovered, repaired, replaced or removed by the contractor in a timely manner.

See ***Section 642-27*** **(Plan Note 642-27)** for more detail regarding erection of R11-H5a signs on multi-lane construction projects.

2. For maintenance work by **ODOT** forces, the **District Highway Management Administrator** shall identify those specific work areas which meet the criteria for erection of R11-H5a signs and arrange for furnishing signs, sign erection, maintenance covering and removal accordingly.

3. For non-**ODOT** construction, maintenance or utility work, a construction company, utility company or property owner may propose work within the right-of-way of a rural state highway and request a permit for such work under the requirements of **SOP PH-P-403.** At that time the company or property owner may also request permission to use R11-H5a signs for specified portions of the work. The request shall include a plan showing the proposed size, location and duration of erection of each sign. If approved, the company or owner shall be responsible to furnish the appropriate signs and erect, maintain, cover, uncover and remove them in accordance with the requirements of this section.

Code No.	Route Type	Size Inches (millimeters)
R11-H5a	Conventional	24 x 48 (600 x 1200)
R11-H5a	Major Conventional*, Expressway & Freeway	48 x 96 (1200 x 2400)

* See ***Section 209-6.2***.

605-5 Warning Signs

605-5.1 General

Warning Signs in temporary traffic control zones are addressed in **OMUTCD Chapter 6F**. This section will be used to provide additional information about Warning Signs discussed in the **OMUTCD** if needed. Information about Warning Signs used in temporary traffic control zones that are not currently addressed in the **OMUTCD** are discussed in ***Section 605-6***.

If a temporary traffic control zone requires Warning Signs different from those existing, the existing permanent Warning Signs shall be removed or covered and superseded by the appropriate temporary Warning Signs.

Signing in the advance warning area **(OMUTCD Figure 6C-1 and *Figure 698-1*)** must be adequate to inform the approaching road user of conditions downstream. The ROAD WORK AHEAD sign (W20-1), is normally provided and is followed by appropriate signing for the conditions at the site (see **OMUTCD Part 6** and the MT series of **SCDs**). When there is a need to provide notice for several miles in advance, it is necessary to repeat the ROAD WORK AHEAD sign every mile and to supplement it with a plate to provide the distance to the beginning of the work. Where traffic queues are expected to develop, advance notice of the potential for stopped traffic should be identified by the proper signing, such as BE PREPARED TO STOP (W3-4).

Portable changeable message signs (PCMS) are very helpful in providing advance information

to approaching traffic, particularly if this information is to be modified frequently. See ***Section 605-9*** for more information on PCMSs.

605-5.2 Design

As noted in **OMUTCD Section 6F.15**, with some exceptions, Warning Signs shall be diamond shaped with a black symbol or message on an orange background. Mounting or space considerations may justify a change from the standard diamond shape, but such variations require prior approval of the highway authority.

Warning Signs used for incident management shall have an orange background. However, in emergencies, available signs having yellow backgrounds may be used if orange signs are not readily available.

605-5.3 Sizes

Except as noted herein, signs used for temporary traffic control zones and incident areas shall be sized based on the provisions of **OMUTCD Chapter 6F**.

605-5.4 Spacing

Where highway conditions permit, Warning Signs should be placed at varying distances in advance of the work area, depending on the roadway type, condition and speed. Where a series of two or more Warning Signs is used, the closest sign to the work area should be placed approximately 100 feet (30 meters) away for low-speed urban streets to 1,000 feet (300 meters) away or more for expressways and freeways.

OMUTCD Table 6C-1 presents the suggested spacing of Warning Signs for four general roadway types: urban (low speed), urban (high speed), rural and expressway/freeway.

605-5.5 ROAD (STREET) CLOSED AHEAD Sign (W20-3)

As noted in **OMUTCD Section 6F.19**, the ROAD (STREET) CLOSED AHEAD sign (W20-3) should be used ahead of that point where a highway is closed to all traffic, or to all but local traffic. It may be used in conjunction with appropriate distance legends or with other Warning Signs. The 48-inch (1200 millimeters) size sign shall be used regardless of highway classification.

605-5.6 ONE LANE ROAD AHEAD Sign (W20-4)

As noted in **OMUTCD Section 6F.20**, the ONE LANE ROAD AHEAD sign (W20-4) shall be used only in advance of that point where motor vehicle traffic in both directions must use a common single lane. The 48-inch (1200-millimeters) size sign shall be used regardless of highway classification.

605-5.7 LANE(S) CLOSED AHEAD Sign (W20-5, W20-5a)

As noted in **OMUTCD Section 6F.21**, the LANE CLOSED AHEAD sign (W20-5) shall be used in advance of that point where one or more lanes of a multiple-lane roadway are closed. The sign may be used in repetition or in conjunction with appropriate distance legends or with other Warning Signs. The 48-inch (1200 millimeters) size sign shall be used regardless of highway classification.

605-5.8 Flagger Sign (W20-7, W20-7a)

As noted in **OMUTCD Section 6F.29**, the Flagger symbol sign (W20-7a) should be used before

any point where a flagger is stationed to control traffic. The sign may be used in conjunction with other Warning Signs, such as BE PREPARED TO STOP (W3-4). The 48-inch (1200 millimeters) size sign shall be used regardless of highway classification.

605-5.9 SURVEY CREW AHEAD Signs (W21-H6)

As noted in **OMUTCD Section 6F.35**, the SURVEY CREW AHEAD sign (W21-H6) should be used to warn of survey crews working in or next to the roadway.

605-5.10 Blasting Zone Signs (W22-1, W22-2, W22-3)

As noted in **OMUTCD Sections 6F.38 through 6F.40**, Blasting Zone signing shall be used in advance of a temporary traffic control zone where explosives are being used.

605-5.11 Construction Arrow Sign (W1-H11)

The Construction Arrow sign (W1-H11) **(see OMUTCD Section 6F.44-1)** should be used where it is necessary to guide traffic through construction areas, or where road work is in progress. This sign is often placed along lane shifts where it may be determined that traffic guidance is necessary. Examples of use of the Construction Arrow sign are presented in **OMUTCD Figures 6H-31, 6H-32 and 6H-36** and in **SCDs MT-102.10** and **102.20**.

605-5.12 SHOULDER CLOSED Signs (W21-5a, W21-5b)

SHOULDER WORK signs are addressed in **OMUTCD Section 6F.34**. On expressways and freeways, the RIGHT (LEFT) SHOULDER CLOSED sign (W21-5a) and RIGHT (LEFT) SHOULDER CLOSED AHEAD sign (W21-5b) should be used in advance of the point where the shoulder work occurs and should be preceded by a ROAD WORK AHEAD sign (W20-1).

Code No.	Route Type	Size Inches (millimeters)
W21-5a & W21-5b	Conventional	36 x 36 (900 x 900)
W21-5a & W21-5b	Expressway & Freeway	48 x 48 (1200 x 1200)

605-5.13 SHOULDER DROP-OFF Sign (W8-9a)

SHOULDER DROP-OFF signs are addressed in **OMUTCD Section 6F.41**. The SHOULDER DROP-OFF sign (W8-9a) is intended for use when a shoulder drop-off, adjacent to the travel lane, exceeds 3 inches (76 mm) in depth and is not protected by a portable barrier. Where the sign is appropriate, it shall be installed by the end of the day in which the drop-off is created.

Guidance for proper protection under such conditions in active work zones is provided in the **Plan Insert Sheet (PIS) No. 2010190**, Drop-Offs in Work Zones, which is available from the **Office of Traffic Engineering** web page. If the Guidance in the Plan Insert sheet is followed, there will be no need for the W8-9a sign.

Code No.	Route Type	Size Inches (millimeters)
W8-9a	Conventional	36 x 36 (900 x 900)
W8-9a	Expressway & Freeway	48 x 48 (1200 x 1200)

605-5.14 UNEVEN LANES Sign (W8-11)

UNEVEN LANES signs are addressed in **OMUTCD Section 6F.42**. The UNEVEN LANES sign, W8-11 should be used during operations that create a difference in elevation between adjacent lanes.

Code No.	Route Type	Size Inches (millimeters)
W8-11	Conventional	36 x 36 (900 x 900)
W8-11	Expressway & Freeway	48 x 48 (1200 x 1200)

605-5.15 NO CENTER (EDGE) LINE Sign (W8-H12, W8-H13)

NO CENTER (EDGE) LINE signs are addressed in **OMUTCD Section 6F.43**. The NO CENTER (EDGE) LINE sign should be used when the work obliterates the center (or edge) stripe. This sign should be placed at the beginning of the zone and repeated at 2-mile (3.2 kilometers) intervals in long zones to remind the road users. It should also be used at major connections, traffic generators, and/or at appropriate intervals as determined by the project engineer, to advise road users entering within the zone. For acceptable temporary pavement marking standards see ***Section 605-11.11***.

Code No.	Route Type	Size Inches (millimeters)
W8-H12 & W8-H13	Conventional	36 x 36 (900 x 900)
W8-H12 & W8-H13	Major Conventional*, Expressway & Freeway	48 x 48 (1200 x 1200)

* See ***Section 209-6.2***.

605-6 Special Warning Signs

This section is intended to address signs developed for use on **ODOT**-maintained highways that are not currently addressed in the **OMUTCD**. As noted in **OMUTCD Section 6F.44**, there may be a need for various Warning Signs that are not in **OMUTCD Part 6**. Some of these will be found in **OMUTCD Part 2** and others, as noted in **OMUTCD Section 2F.55**, may be developed because of special conditions not yet addressed in the **OMUTCD**. These “special” Warning Signs may eventually be incorporated into the **OMUTCD**; however, if their use is limited they may not be incorporated into that manual. Special Warning Signs should conform to the general requirements of color, shape and alphabet size and series. The sign message should be brief, legible and clear.

605-7 Guide Signs

605-7.1 General

Guide Signs in temporary traffic control zones are addressed in **OMUTCD Chapter 6F**. This section will be used to provide additional information about Guide Signs discussed in the **OMUTCD** if needed. Information about Guide Signs used in temporary traffic control zones that are not currently addressed in the **OMUTCD** are discussed in ***Section 605-8***.

If a temporary traffic control zone requires guidance information different from that existing, the existing permanent Guide Signs shall be removed or covered and superseded by the appropriate temporary Guide Signs.

605-7.2 DETOUR Signs and Markers (M4-8a, M4-8b, M4-9, M4-H9b, M4-10)

As noted in **OMUTCD Section 6F.50**, each detour shall be adequately marked with standard temporary Route Markers and destination signs.

A Route Marker or Street Name sign should be placed above or incorporated in the DETOUR sign to indicate the name of the route being detoured.

An End Detour sign (M4-8a or M4-8b) may be used to indicate that the detour has ended.

605-7.3 Advance Work Zone Information Signs

Advance Work Zone Information Signs may be required as part of the maintenance of traffic plan for major construction projects. The need for these signs is usually determined by the corridor management team during their review of the project. The signs are fixed message types and advise the road user of alternate routes, possible delays, etc. The signs are generally located at extreme distances form the work area.

To insure uniformity in the design and application of these signs, the following guidelines will apply:

1. These signs shall be shown in the plans whether supplied by the contractor or by others (this choice shall be clearly indicated in the plans). The normal procedure is for the contractor to provide the signs.

2. The location of the signs shall be field checked by the designer to insure that there are no conflicts with existing features and other signs in the area. The designer will assure that signs are not blocked by being too close to other signs and that the road user has sufficient time to read, understand and act on the information provided by all of the signs.

3. The plans shall indicate the legend, level and size of the signs. The signs shall be considered Supplemental Guide Signs as described in **OMUTCD Section 2E.32.**

4. The signs shall be black on orange (including a black border). The layout shall conform to the **OMUTCD** and **ODOT** Guide Sign design standards **(see SDM Appendix C)**.

5. Where appropriate, advance work zone information signs shall make use of the same exit numbers, route numbers, directions and destinations as shown on the permanent Guide Signs.

6. In some instances, instead of providing separate installations, it may be desirable to modify existing overhead guide signs. These changes are accomplished by providing black-on-orange overlays to cover portions of the existing signs. Letter size on these overlays should

be the same as on the existing signs. When lane arrows are to be covered, rather than using a blank overlay, the legend "LANE CLOSED" shall be used. When a ramp is being closed, rather than using a blank overlay to cover the entire sign, the legend "CLOSED" shall be used on a diagonal overlay (lower left to upper right) on the sign. The size of lettering on overlays and the size of the overlay shall be indicated in the plans. The minimum letter size for "LANE CLOSED" shall be 10-inch (254-millimeter) E.

7. When regulatory information is provided, it shall be displayed separately as a standard black-on-white sign. Mixing black-on-white regulatory information on a black-on-orange information sign is prohibited.

8. If the road user is being detoured, or if an alternate route is provided, the route should be signed with assemblies consisting of the appropriate black-on-orange (DETOUR OR ALT) markers with a standard Route Marker and arrow plate. If more target value is desired, this trailblazer information may be shown on an orange panel, M2-H3 type.

   Route Marker assemblies shall be sized according to the type of road on which they are located in accordance with the **OMUTCD**.

9. Supports for sign installations shall conform to all existing standards for permanent signs. These signs should not be attached to existing supports.

10. All advance work zone information sign installations located outside of the project work limits shall be paid for under appropriate **630 Items** (signs, supports, concrete, breakaway connection, overlays, removals, etc.). They shall not be included in the lump sum bid for **Item 614**. This requirement does not apply to Advance Warning Signs or to sign installations within the work limits.

605-8 Special Guide Signs

605-8.1 General

This section is intended to address signs developed for use on **ODOT**-maintained highways that are not currently addressed in the **OMUTCD**. There may be a need for various "special" Information (Guide) Signs that are not in the **OMUTCD**. They may eventually be incorporated into the **OMUTCD**; however, if their use is limited they may not be incorporated into that manual. Special Guide Signs should conform to the general requirements of color, shape and alphabet size and series. The sign message should be brief, legible and clear.

605-8.2 TRUCK Marker (M4-4)

This sign shall be used with standard Detour signs when it is necessary to establish a detour for truck traffic, but not other vehicles.

605-8.3 Notice of Closure Signs (W20-H13, W20-H14)

Notice of Closure signs (W20-H13 and W20-H14) are intended to give advance notice to the road user of a scheduled road closure. The information provided on these signs includes the scheduled date of closure and the number of days of scheduled closure. Additionally, W20-H13 provides a telephone number for information and is the preferable sign. The selected sign should be erected at the point of closure except that more flexibility is acceptable in locating the signs on ramps. The sign should be erected at least one week in advance of a scheduled road or ramp closure and shall be erected on the right-hand side of the road or ramp, facing traffic. Additional details on placement of the Notice of Closure signs is provided in ***Section 642-8*** **(Plan Note 642-8)**.

W20-H13

W20-H13, H14
60" x 36"
(1500 mm x 900 mm)

W20-H14

605-8.4 Exit Ramp Open/Closed Signs (E5-2, E5-3, E5-H3, E5-H3a)

Use of these signs is illustrated in **OMUTCD Figures 6H-41 and 6H-42**.

605-9 Portable Changeable Message Signs (PCMSs)

Portable Changeable Message Signs (PCMS) **(see OMUTCD Section 6F.52)** are traffic control devices with the flexibility to display a variety of messages to fit the needs of road and street authorities. These signs are used most frequently on high density, urban freeways, but have applications on all types of highways where highway alignment, traffic routing problems or other pertinent conditions require advance warning and information.

In addition to the standards and guidelines in **OMUTCD Section 6F.52** and herein, additional guidelines for use of PCMSs can be found in **ATSSA's Guidelines for the Use of Portable Changeable Message Signs**.

As noted in **OMUTCD Section 6F.52**, when abbreviations are used, they should be easily understood. A list of common abbreviations is provided in **OMUTCD Tables 1A-1 and 1A-2**.

Portable Changeable Message Signs will typically be placed in advance of any other temporary traffic control zone signing and should not replace any required signing. The location of the PCMS may have to be adjusted to keep the sign an appropriate distance in advance of traffic queues. Instead of relocating, an additional PCMS may be employed.

Diesel powered PCMSs should not be used in residential areas at night.

A list on the **ODOT** web site at http://www.dot.state.oh.us/testlab/applists/misc/pcms.htm shows portable changeable message signs approved for use on **ODOT** jobs.

605-10 Arrow Panels

605-10.1 General

An arrow panel is a sign with a matrix of elements capable of either flashing or sequential displays. This sign shall provide additional warning and directional information to assist in merging and controlling road users through or around a temporary traffic control zone.

Arrow panels are used primarily on multi-lane highways to notify road users of the need to exit the presently occupied lane due to lane closure. Under such conditions, the use of the arrow panel shall be mandatory. Where a multi-lane closure is necessary, a separate arrow panel shall be used for each closed lane.

On two-lane highways, the panels may be used only in the caution mode. Display of the arrow or chevron modes shall not be permitted on two-lane highways.

A list posted on the **ODOT** web site at http://www.dot.state.oh.us/testlab/applists/misc/faps.htm shows solar powered arrow panels approved for use on **ODOT** jobs.

An arrow panel should be used in combination with appropriate signs, channelizing devices, or other temporary traffic control devices. Arrow panels will not solve difficult traffic problems by themselves, but can be very effective when properly used to reinforce signs and other traffic control devices. Necessary signs, barricades and traffic control devices shall be used in conjunction with the arrow displays.

Diesel powered panels should not be used in residential areas at night.

605-10.2 Design

Arrow panel shall meet the minimum size, legibility distance, number of elements, and other specifications shown in **OMUTCD Section 6F.53 and Figure 6F-3** and in **SCD MT-35.10**.

Type A arrow panels are appropriate for use on low-speed (≤ 40 miles per hour) urban streets. Type B arrow panels are appropriate for intermediate-speed (40 to 50 miles per hour) facilities and for maintenance or mobile operations on high-speed (≥ 45 miles per hour) roadways. Type C arrow panels are intended to be used on high-speed, high-volume roadways.

For additional guidance and requirements on use of arrow panels, see **OMUTCD Section 6F.53.**

605-11 Channelizing Devices

605-11.1 General

Channelizing devices guide road users through the work zone, indicate hazardous areas, and exclude road users from the actual work space. The following sections provide information on channelizing devices that is in addition to the standards and guidelines provided in **OMUTCD Chapter 6F.** For information on barriers, see **OMUTCD Sections 6F.62 through 6F.64** and ***Sections 605-11.7* and *605-14***.

Channelizing devices for use in temporary traffic control applications include cones, tubular markers, vertical panels, reflectorized plastic drums, barricades, direction indicator barricades, weighted channelizers and barriers. Portable concrete and plastic water-filled barriers may also be used as channelizing devices. Intermixing of various types of channelizing devices (e.g., drums and cones) is not permitted.

Channelizing devices and their application shall conform to the **OMUTCD**, the following **TEM** sections and the **SCDs**. Temporary barriers are discussed in further detail in ***Section 605-14***. Crash cushions are discussed in ***Section 605-15***. Temporary impact attenuators are discussed in ***Section 605-15.3***. Also see ***Section 640-2*** for a discussion of some exceptions.

605-11.2 Placement

As noted in **OMUTCD Section 6F.55**, the spacing of channelizing devices in a taper should not exceed a distance in feet equal to the speed limit in miles per hour. For example, if the taper is on a roadway with an existing 55 miles per hour speed limit, the devices should be spaced at about 55 feet.

To keep traffic out of a closed lane on a tangent section, channelizing devices should be spaced a distance in feet of no more than two times the speed limit in miles per hour.

Also, when channelizing devices have the potential of leading motor vehicle traffic out of the

intended motor vehicle traffic space, the devices should be extended a distance in feet of two times the speed limit in miles per hour beyond the end of the transition area. This situation is illustrated for the "southbound" traffic in **OMUTCD Figure 6H-39**. In this typical application, the line of channelizing devices used for the "southbound" left-lane closing has been extended to help avoid the possibility that the devices used to delineate the crossover may also lead the traffic moving back into the "southbound" left lane into the median area.

All channelizing devices used in maintaining traffic should have a minimum lateral offset from the edge of the traveled lane of 1.5 feet (0.5 meter). A lateral offset of less than 1.5 feet (0.5 meter) may be used in instances when the project length is short. However, attempts to provide larger offsets should be made whenever possible.

605-11.3 Cones

This section addresses requirements for traffic cones that are in addition to those found in **OMUTCD Section 6F.56**.

Reflectorization of cones shall be as specified in **OMUTCD Section 6F.56**, and accomplished with bands of Type G reflective sheeting **(CMS 730.191)**.

Except for pavement marking operations, the minimum height for cones shall be 28 inches. Cones used to protect the line during a pavement marking operation may be 18 inches **(see SCD MT-99.20)**.

In addition to the above requirements the following requirements shall apply:

1. The use of cones on freeways and other multi-lane highways shall be limited to short-term stationary lane closures. On freeways and multilane highways, the use of cones shall be limited to operations of twelve hours or less, for either day or night. Upon completion of work within this time period, the cones shall be removed. The cones may again be placed on the highway when the work is to resume on the following day or night. Cones used at night on freeways and other multilane highways shall be at least 42 inches (1.1 meters) in height. Any lane closure using channelization devices, expected to remain for more than twelve hours, shall require the use of drums or barriers.

   Night use of cones on freeways and other multilane highways shall be limited to that portion of the closure which is beyond the transition taper area. Night channelization of such transition taper shall be by use of drums.

   Maximum spacing of cones, when used at night, should be 40 feet (12 meters).

2. On other highways, there are no restrictions on the duration of work for use of cones, day or night. On these roadways, night use of cones is permitted along the entire zone, along the transition taper and beyond.

605-11.4 Drums

605-11.4.1 General

This section addresses requirements for drums used for traffic warning or channelization that are in addition to those found in **OMUTCD Sections 6F.59**.

Drums shall be ballasted in accordance with the manufacturer's recommendations.

Drums shall be kept clean so that reflectivity is not compromised. Concrete sawing operations

splash residue on sheeting, rendering it ineffective.

Owner identification markings on construction drums shall be no more than 1 inch (25 millimeters) in character height and located at least 2 inches (50 millimeters) below the reflectorized band or on the top or bottom horizontal surfaces of the drum.

Drums shall be reflectorized with Type G reboundable sheeting complying with the requirements of **CMS 730.191**. Additional information regarding use of drums is available in **CMS 614.03**.

605-11.4.2 Lights on Drums

ODOT's use of warning lights **(OMUTCD Section 6F.72 and *TEM Section 605-12.5*)** on drums is limited to Type A flashing lights for identification of spot hazards. **ODOT** does not use Type C steady-burning warning lights on drums. Research projects sponsored by **ODOT** and **FHWA** demonstrated that benefits from steady-burn warning lights mounted on reflectorized drums are insignificant. Therefore, the use of these lights on reflectorized drums used as channelizing devices was terminated at the end of the 1991 construction season.

ODOT will not fund steady-burning (Type C) warning lights on drums used for the purpose of channelization on **ODOT**-administered projects. If a local agency desires to include lights on drums for channelization, the additional cost of the lights must be funded with local funds.

605-11.5 Barricades, Tubular Markers and Vertical Panels

This section addresses requirements for barricades, tubular markers and vertical panels that are in addition to those found in **OMUTCD Sections 6F.57, 6F.58 and 6F.60**.

Faces of barricades and vertical panels shall be reflectorized with Type G or Type H sheeting complying with **CMS 730.19 and 730.192**.

As with cones ***(Section 605-11.3)***, all tubular markers shall be reflectorized with bands of Type G sheeting. For details on band widths and sequencing see **OMUTCD Section 6F.57**.

605-11.6 Direction Indicator Barricade

The Direction Indicator Barricade **(see OMUTCD Section 6F.61 and Figure 6F-4)** may be used in tapers, transitions and other areas where specific directional guidance to road users is necessary. However, if used, Direction Indicator Barricades should be used in series to direct road users through the transition and into the intended travel lane.

605-11.7 Barrier Used as a Channelizing Device

Temporary traffic barriers **(see OMUTCD Section 6F.62)** shall not be used solely to channelize road users, but also to protect the work space. When used for channelization, temporary traffic barriers should be of a light color for increased visibility. For nighttime use, the temporary traffic barrier shall also be supplemented with delineation ***(see Sections 605-14.1, 605-14.4.2 and 605-19)***. For additional information, refer to **OMUTCD Section 6F.62** and ***Section 605-14***.

605-11.8 Temporary Raised Islands

Temporary raised islands **(see OMUTCD Section 6F.63)** shall be used only in combination with pavement markings and other suitable channelizing devices. Except when recommended by an engineering study, they should only be used on roadways with speeds of 40 mph (70km/h) or less.

605-11.9 Opposing Traffic Lane Divider

The Opposing Traffic Lane Divider sign **(see OMUTCD Section 6F.64)** is a delineation device used in a series to separate opposing motor vehicle traffic on a two-lane, two-way operation. Its use is limited to locations where speeds are 40 mph (70 km//h) or less. A design is available upon request from the **Office of Traffic Engineering (OTE)**.

605-11.10 Pavement Markings

605-11.10.1 General

This section provides additional information and support for information in **OMUTCD Section 6F.65**. The provisions of this section of the **TEM** shall not be considered applicable for short-term, mobile or incident management temporary traffic control zones.

Either permanent or temporary pavement markings shall be in place prior to opening the road or lane to road users. See ***Section 605-11.11*** for additional information on temporary pavement markings.

Adequate pavement markings shall be maintained along paved streets and highways in temporary traffic control zones. The intended vehicle path should be defined in day, night, and twilight periods under both wet and dry pavement conditions. The work should be planned and staged to provide the best possible conditions for the placement and removal of the pavement markings.

Road users should be provided pavement markings within a temporary traffic control zone comparable to the pavement markings normally maintained along such roadways, particularly at either end of the temporary traffic control zone. The following guidelines set forth the level of adequate markings, delineation and obliteration for various temporary traffic control zone situations.

1. All pavement markings shall be in accordance with **OMUTCD Chapters 3A and 3B**, except as indicated in ***Section 605-11.11***.

2. Pavement markings shall be maintained along highways in all long- and intermediate-term stationary temporary traffic control zones ***(see Section 606-3)***. The pavement markings shall match the markings in place at both ends of the temporary traffic control zone. Particular attention should be given to ramp gore areas.

3. Pavement markings shall be placed, along the entire length of any surfaced detour or temporary roadway prior to the detour or roadway being opened to road users.

4. Markings should be provided in intermediate-term stationary work areas.

5. Warning Signs, channelizing devices and delineation shall be used to indicate required road user paths in temporary traffic control zones where it is not possible to provide a clear path by pavement markings.

6. For long-term stationary operations, pavement markings in the temporary traveled way that are no longer applicable shall be removed or obliterated as soon as practical. Pavement marking obliteration shall leave a minimum of pavement scars and shall remove old marking material. Painting over existing pavement markings with black paint or spraying with asphalt shall not be accepted as a substitute for removal or obliteration. Removable, nonreflective, preformed tape may be used where markings need to be covered temporarily ***(see Section 605-11.10.2)***.

7. All markings and devices used to delineate road user paths shall be carefully reviewed during daytime and nighttime periods.

605-11.10.2 Conflicting Pavement Markings

Conflicting pavement markings shall be removed by an approved method which will not scar the pavement or may be covered with removable, nonreflective, preformed tape which blends in with the existing pavement surface. Should it be decided to use the removable tape, the tape must be closely monitored, as it may be displaced due to traffic passing over it or inclement weather conditions. See ***Section 620-6*** and **CMS 614.10 and 641.10** for additional information.

605-11.11 Temporary Pavement Markings

As noted in ***Section 605-11.10.1***, either permanent or temporary pavement markings shall be in place prior to opening the road/lane to traffic.

Temporary, or interim, pavement markings are those that are allowed to remain in place until the earliest date when it is practical and possible to install pavement markings that meet the **OMUTCD Part 3** standards for pavement markings. They should not be left in place for more than fourteen days unless justified by an engineering study.

In areas of long line work such as resurfacing, where the roadway or lane remains open during construction, the new pavement marking shall be placed within fourteen days of removal or obliteration of the existing line(s). NO EDGE LINES (W8-H13) signs shall be erected at locations lacking necessary edge lines.

All temporary pavement markings, including pavement markings for No-Passing Zones, shall conform to the requirements of **OMUTCD Chapters 3A and 3B** with the following exceptions:

1. All interim broken-line pavement markings shall use the same cycle length as permanent markings and be at least 4 feet (1.2 meters) long, except that half-cycle lengths with a minimum of 2-foot (0.6-meter) stripes may be used for roadways with severe curvature **(see OMUTCD Section 3A.06)**. This applies to white lane lines for traffic moving in the same direction and yellow center lines for two-lane roadways when it is safe to pass.

2. The center line shall either be full dimensional for No-Passing Zones or an abbreviated Class II center line may be used for a maximum of three consecutive calendar days as long as NO PASSING (R4-1) and PASS WITH CARE (R4-2) signs are erected as required by **CMS 614.04**. At the end of the three day time period, a center line consisting of full dimensional no passing markings must be installed. Also, signs may be used instead of pavement markings on low-volume (as defined in ***Section 500***) roads for longer periods. These signs should be placed in accordance with **OMUTCD Sections 2B.24, 2B.25 and 2C.32**.

3. Edge lines shall be provided except for short periods at locations where another form of identification is provided, such as drums or cones.

4. Interim gore marking shall be continuous 4-inch (100-millimeter) lines placed at the theoretical gore of an exit ramp or diverging roadway.

605-11.12 Raised Pavement Markers

The use of temporary raised pavement markers in temporary traffic control zones is addressed in **OMUTCD Section 6F.67 and SCDs MT-95.70, 95.80, 96.10, 96.11 and 101.20.**

Raised pavement markers should be considered for use along surfaced detours or temporary roadways, and other changed or new travel-lane alignments.

605-11.13 Delineators

As noted in **OMUTCD Section 6F.68**, delineators may be used in temporary traffic control zones to indicate the alignment of the roadway and to outline the required vehicle path through the temporary traffic control zone. When used, delineators shall be used in combination with, or be supplemental to, other traffic control devices.

Delineators shall be mounted on crashworthy supports so that the reflecting unit is approximately 4 feet (1.2 meters) above the near roadway edge. The standard color for delineators used along both sides of two-way streets and highways and the right side of one-way roadways shall be white. Delineators used along the left side of one-way roadways shall be yellow. Spacing along roadway curves should be as set forth in **OMUTCD Section 3D.04**, and should be such that several delineators are always visible to the driver.

605-12 Lighting Devices

605-12.1 General

Lighting devices **(OMUTCD Section 6F.69)** should be provided in temporary traffic control zones based on engineering judgment. They may be used to supplement retroreflectorized signs, barriers and channelizing devices.

Four types of lighting devices are commonly used in temporary traffic control zones. They are floodlights, flashing warning beacons, warning lights and steady-burn electric lamps.

During normal daytime maintenance operations, the functions of flashing warning beacons are adequately provided by rotating lights or strobe lights on a maintenance vehicle. Vehicle hazard warning lights are permitted to be used to supplement rotating or strobe lights; however, they shall not be used instead of rotating or strobe lights.

605-12.2 Floodlights

Standards and guidelines for the use of floodlights in temporary traffic control situations are addressed in **OMUTCD Section 6F.70**.

Lighting is often provided to illuminate the roadway at locations of significant geometric change. For example:

1. All temporary crossover areas shall be illuminated as shown in **SCD MT-100.00.**

2. When a lane shift will be used for over fourteen consecutive days and existing lighting is not available, consideration may be given to providing a temporary lighting system along the tapers. Illumination of shift areas is illustrated in **SCD MT-102.10.**

3. Lighting shall be provided along tapers on high-speed highways which are not permanently lighted if the taper rate does not meet the minimum requirements called for in Table II of **SCD 102.10.** Continuous lighting of the work areas between tapers is only required when the tapers are provided with temporary lighting and the distance between the tapers is less than 2000 feet (610 meters).

605-12.3 Flashing Warning Beacons

Flashing Warning Beacons **(see OMUTCD Section 6F.71)** are often used to supplement a temporary control device.

The temporary terminus of a freeway is an example of a location where Flashing Warning Beacons alert drivers to the changing roadway conditions and the need to reduce speed in transitioning from the freeway to another roadway type.

605-12.4 Steady-Burn Electric Lamps

As noted in **OMUTCD Section 6F.73**, steady-burn electric lamps are a series of low-wattage, yellow, electric lamps, generally hard-wired to a 110-volt external power source. They may be used in place of Type C steady-burning Warning Lights ***(see Section 605-12.5)***.

605-12.5 Warning Lights

Warning lights are portable, powered, yellow lens-directed, enclosed lights **(see OMUTCD Section 6F.72)**. They may be used in either flashing (Type A or B) or steady (Type C) modes. The light weight and portability of warning lights are advantages that make these devices useful as supplements to the retroreflectorization on signs and channelizing devices. See ***Section 605-11.4.2*** for additional information about the use of steady-burn warning lights with drums.

605-13 Temporary Traffic Control Signals

605-13.1 General

It is often necessary to install temporary traffic signals in order to maintain traffic through temporary traffic control zones. As noted in **OMUTCD Section 6F.74**, temporary traffic control signals used to control road user movements through temporary traffic control zones and in other temporary traffic control situations shall meet the applicable provisions of **OMUTCD Part 4**. **OMUTCD Section 6F.74** and this chapter provide additional information on the use of traffic signals in temporary traffic control zones. ***Part 4*** of this Manual should also be reviewed for applicable information.

OMUTCD Figure 6H-12 and **SCDs MT-96.10, 96.11 and 96.21** address the use of temporary traffic signals to maintain two-way traffic in a single lane ***(see Section 641-10)***. Additional guidance on the design of temporary traffic control signals is provided in ***Section 605-13.2*** and in the **Plan Insert Sheets** available at the **OTE** web site.

For common procedures for maintaining traffic signals during construction, see the maintenance of traffic signals and flasher notes found in ***Section 642.***

When temporary traffic control signals are used, conflict monitors typical of traditional traffic control signal operations shall be used.

605-13.2 Portable Traffic Signals (PTS)

Temporary Traffic signals which will be in continuous operation for fourteen days or less shall be designed, operated and installed in accordance with **SCDs MT-96.10, 96.11, 96.21, 96.25 and 96.26** ***(see Section 641-10)*** with the following exceptions and qualifications:

- Luminaires for area illumination are not required.
- Temporary pavement markings and temporary raised pavement markers are not required for

signalized operations lasting less than thirty-six hours.

- When signalized operation will last less than thirty-six hours, removal of existing conflicting pavement markings is not required if drums (or cones during daylight hours only) provide continuous positive guidance for vehicles.

- Signal systems of this type shall not be used for situations where traffic, including contractors vehicles, will be entering the traffic stream, from the work site, between signals.

The traffic signal system may either be constructed of standard signal components conforming to **SCDs MT-96.10, 96.11, 96.21, 96.25 and 96.26** ***(Section 641-10)***, or it may be a portable traffic signal (PTS) which is essentially self contained and mounted on trailers. The PTS shall conform to the following criteria:

1. The PTS shall conform to all **OMUTCD** requirements for traffic control signals including **Section 4D.20.**

2. Each signal head shall have three 12-inch vehicular indications (red, yellow and green) and their candlepower distributions shall not be less than specified for standard 12-inch signal heads in the **ITE Standard for Adjustable Face Traffic Signal Heads**.

3. The systems may be powered by engine driven generators or by stored battery charge. The systems, including batteries, shall be designed to provide electrical energy which will maintain the above described candlepower distribution for at least twenty-four hours at full output.

4. The dimming of a PTS shall be permitted in accordance with the **OMUTCD**. The unit may include a photocell and circuitry which will permit the yellow lens of the PTS light output to be reduced by up to fifty percent during night hours. The amount of dimming, and the choice of not dimming shall be operator selectable.

5. The signal unit generator battery and electronic controls shall be completely inaccessible to unauthorized access, and protected by a sturdy lockable metal enclosure.

6. Signal supports shall consist of sturdy brackets attached to a trailer. The erected assembly shall be designed to solidly support the roadside signals at the specified heights and be designed for 40 mile per hour (65 kilometers per hour) wind loads. Signal head configurations for each approach shall be one post-mounted signal at 8 foot (2.4 meter) minimum height on the right side of the road, plus another signal cantilever mounted over the right-hand traffic lane at a minimum height fo 15 feet (4.5 meters); or two post-mounted signal heads, each erected at 8 foot (2.4 meter) minimum height on both sides of the road. The lateral spacing between signals shall be not less than 8 feet (2.4 meters).

7. The trailer and supports shall be orange. The signal heads shall be yellow.

8. The control portion of the PTS shall meet **NEMA** environmental standards. An independent laboratory test report shall be provided to verify compliance with the **NEMA** environmental standards.

9. The PTS shall be capable of operating in manual, fixed-time and traffic-actuated modes.

10. The controllers for the PTS system shall electronically communicate to each other by cable, radio or other method approved by the **Director**.

11. It shall not be possible even under manual control: (1) to program the yellow clearance interval for less than three seconds; or (2) for the green interval to be displayed for less than five

seconds.

12. All timing intervals shall be set in increments of one second or less.

13. The controller shall provide a variable all red clearance interval from zero to six hundred seconds.

14. The controller shall provide a method for insuring that the pairs of signal heads cannot display conflicting indications. This shall include at least a system which will identify, as a conflict, the display of a green in one direction while: (1) displaying a green in the conflicting direction; (2) displaying a yellow in the conflicting direction; or (3) displaying the all-red clearance interval for a conflicting approach. Further, a controller will be determined to be in conflict if a displayed green is less than five seconds or a displayed yellow is less than three seconds. Upon determination that a conflict exists, all signal heads shall display flashing red as described in **item 15**.

15. The controller shall provide a red flash cycle that shall be flashed continuously at a rate of not less than fifty nor more than sixty times per minute. The illuminated period of each flash shall be not less than half, nor more than two-thirds, of the total flash cycle.

16. The controller shall have circuitry which will detect low voltage and prevent the occurrence of an unsafe signal indication. This “brown out” circuit shall hold the signal safe until adequate voltage is resumed. If a microprocessor is utilized, appropriate circuitry shall be included that will reset the processor when needed while holding the signal in an all-red condition. When the processor is removed from the circuitry, the signal shall default to a safe condition.

17. If the PTS utilizes radio transmission equipment:

    a. The transmitter shall be an accepted **FCC**-type and shall not exceed 1 watt output per **FCC Part 90.17**. The manufacturer shall also comply with all specific limitations noted in **FCC Part 90.17**.

    b. In case of radio interference or failure, the PTS shall display all red.

    c. If an **FCC** license is required, a copy shall be kept on file with the contractor.

18. The contractor shall inspect the PTS at least once each hour for the first eight hours after it is set up or reconfigured. Thereafter, he shall inspect it at least every twenty-four hours, including weekends. The inspections are to determine that it is operating correctly and efficiently, signals properly aimed and that the battery charge remains sufficient.

19. The contractor or supplier shall submit a letter signed by the manufacturer certifying that the candidate PTS complies with each of the above requirements. The letter shall also convey detailed engineering information, drawings and descriptions which describe how each requirement is satisfied.

Each PTS determined to meet this specification will be shown on a prequalified list maintained by the **Office of Traffic Engineering**.

605-14 Temporary Traffic Barriers

605-14.1 General

Temporary traffic barriers are devices designed to help prevent penetration by vehicles while minimizing injuries to vehicle occupants, and designed to protect workers, bicyclists and

pedestrians **(see OMUTCD Section 6F.75)**. A typical use is where one side of a bridge is closed for deck repair. They are also used for certain special events or in other temporary traffic control contexts where separation and channelization of vehicle and pedestrian movements are needed. More specific information on the use of temporary traffic barriers is contained in Chapters 8 and 9 of **AASHTO's Roadside Design Guide** ***(see Section 193-12)***.

Temporary traffic barriers, including shifting portable or movable barrier installations to accommodate varying directional motor vehicle traffic demands, may be used to separate two-way motor vehicle traffic.

Because the protective requirements of a temporary traffic control situation have priority in determining the need for temporary traffic barriers, their use should be based on an engineering study. When serving the additional function of channelizing motor vehicle traffic, temporary traffic barriers should be a light color for increased visibility.

Temporary traffic barriers shall be supplemented with standard delineation, pavement markings or channelizing devices for improved daytime and nighttime visibility if they are used to channelize motor vehicle traffic ***(Sections 605-11.7, 605-14.4.2 and 605-19)***. The delineation or pavement marking color shall match the applicable pavement marking color. Warning lights or steady-burn electric lamps may also be mounted on temporary traffic barrier installations.

In order to mitigate the effect of striking the end of a temporary traffic barrier, the end shall be installed in accordance with **AASHTO's Roadside Design Guide** by flaring until the end is outside the acceptable clear zone or by providing crashworthy end treatments.

605-14.2 Movable Barrier

A movable barrier is a linear system of connected barrier segments that can rapidly be shifted laterally by using a specially designed transfer vehicle. The transfer is accomplished in a manner that does not interfere with motor vehicle traffic in adjacent lanes. Applications of movable barriers include the following:

1. Closing an additional lane during work periods while maintaining the advantage of having the travel way separated from the work space by a barrier;

2. Closing an additional lane during off-peak periods to provide extra space for work activities without adversely impacting motor vehicle traffic flow; and

3. Creating a temporary reversible lane, thus providing unbalanced capacity favoring the major direction of motor vehicle traffic flow.

For more information on this device see **OMUTCD Figure 6H-45** and ***Section 606-18***.

605-14.3 Temporary Guardrail

All guardrail used as a temporary barrier in maintenance of traffic applications shall conform to the same standards required for permanent guardrail in **L&D Manual Volume One, Section 603.1.1.**

Guardrail should be as detailed in the current **Roadway Standard Construction Drawings.** Any variation from these standards shall be submitted for approval by the **Office of Roadway Engineering Services** at the design stage, on a case-by-case basis.

Delineation of guardrail shall be by use of barrier reflectors ***(Section 605-19)*** mounted at 50-foot (15.2-meter) spacing.

605-14.4 Portable Concrete Barrier (PCB)

605-14.4.1 Design and Use

The decision to use portable concrete barrier (PCB) is based upon characteristics of the work zone and engineering judgment. The use of PCB should be required during construction in any area where penetration or deflection permitted by other traffic control devices cannot be tolerated. See ***Section 640-23.3*** for detail information about the design of a PCB installation. Additional guidance is provided in the **SCDs MT-95.40, 95.41, 95.70, 99.51 and 102.10**.

605-14.4.2 Barrier Reflectors and Object Markers

Delineation of PCB shall be provided by use of barrier reflectors and object markers. Barrier reflectors shall be mounted on all PCB. Barrier object markers shall be mounted on top of 32-inch (810-mm) PCB.

Maximum spacing for barrier reflectors and object markers shall be 50 feet (15.2 meters) as shown in **SCD MT-102.10**. Where both barrier reflectors and object markers are provided on the same device, these items shall be staggered. See ***Section 605-19*** for further information on barrier reflectors and object markers.

605-14.5 Triton Portable Water-filled Barrier

See ***Table 697-6*** and ***Section 642-32*** for information on this device.

605-15 Crash Cushions

605-15.1 General

As noted in **OMUTCD Section 6F.76**, crash cushions are systems that mitigate the effects of errant vehicles that strike obstacles, either by smoothly decelerating the vehicle to a stop when hit head-on, or by redirecting the errant vehicle. The two types of crash cushions that are used in temporary traffic control zones are stationary crash cushions and truck-mounted attenuators. Crash cushions in temporary traffic control zones help protect the drivers from the exposed ends of barriers, fixed objects, shadow vehicles and other obstacles. Specific information on the use of crash cushions can be found in **AASHTO's Roadside Design Guide *(see Section 193-12)***.

Crash cushions shall be crashworthy. They shall also be designed for each application to stop or redirect errant vehicles under prescribed conditions. Crash cushions shall be periodically inspected to verify that they have not been hit or damaged. Damaged crash cushions shall be promptly repaired or replaced.

605-15.2 Stationary Crash Cushions

605-15.2.1 General

Stationary crash cushions are used in the same manner as permanent highway installations to protect drivers from the exposed ends of barriers, fixed objects and other obstacles. Stationary crash cushions shall be designed for the specific application intended.

605-15.2.2 QuadGuard CZ

The QuadGuard CZ is a redirective, non-gating, crash cushion manufactured by **Energy Absorption Systems, Inc.** It is similar in design to the QuadGuard used in permanent locations, except the CZ has lifting brackets and a different anchoring system. It is typically

used to terminate Type 5 Barrier Design Guardrail, concrete median barrier and other narrow hazards. It can be installed on a concrete pad or asphalt pavement in unidirectional and bidirectional configurations. The bidirectional configuration requires appropriate transitions.

The QuadGuard CZ comes in three widths, 24 inches (610 millimeters), 30 inches (760 millimeters) and 36 inches (915 millimeters).

The six-bay unit is 22'-1" (6.74 meters) long and can be used in work zones where speeds are over 40 miles per hour.

The three-bay unit is 13'-1" (4.00 meters) long and can be used in work zones where speeds are 40 miles per hour and lower.

If cross slopes are steeper than 8 percent or vary by more than 2 percent over the length of the unit, a leveling pad may be used.

Table 697-7 presents resource information on QuadGuard devices for use when selecting crash cushions. See ***Sections 642-30 and 642-31*** for related **Plan Notes** and additional information.

605-15.2.3 TRACC

The TRACC (Trinity Attenuating Crash Cushion) is a redirective, non-gating, crash cushion manufactured by **Syro/Trinity, Inc.** It is 21'-0" (6.4 meters) long and 2'-7" (0.8 meter) wide and comes to the site preassembled. The TRACC can be installed on a new or existing concrete or asphalt pad with 27 anchor studs. The length of the anchor studs depends upon the type and thickness of the supporting pad. Unidirectional and bidirectional configurations are available; however, the bidirectional configuration requires appropriate transitions.

Table 697-6 presents resource information on TRACC devices for use when selecting crash cushions. Also see ***Section 642-30*** for a related **Plan Note** and additional information.

605-15.2.4 Sand Barrels

Sand barrel arrays may be used in work zones to provide temporary protection for wide hazards. For ease of moving, they may be mounted on pallets or skids that are 4 inches (100 millimeters) or less in height. See **L&D Manual Volume One, Section 603.4.4** for additional information.

605-15.3 Truck-Mounted Attenuators

Truck-mounted attenuators shall be energy-absorbing devices attached to the rear of shadow trailers or trucks and they should be used in accordance with the manufacturer's specifications. If used, they shall be located in advance of the work area, workers or equipment to reduce the severity of rear-end crashes from errant vehicles.

Chapter 9 of **AASHTO's Roadside Design Guide** ***(see Section 193-12)*** and ***Section 602-8*** contain additional information regarding the use of shadow vehicles.

For more detail see **L&D Manual Volume One, Section 603.2**.

605-16 Vehicle-Arresting Systems

Vehicle-arresting systems are addressed in **OMUTCD Section 6F.77**.

605-17 Rumble Strips

Rumble strips **(see OMUTCD Section 6F.78 and *TEM Section 1215*)** consist of intermittent narrow, transverse areas of rough-textured or slightly raised or depressed road surface that alert drivers to unusual motor vehicle traffic conditions. Through noise and vibration they attract the driver's attention to such features as unexpected changes in alignment and to conditions requiring a stop.

The first rumble strip pad should be placed before the advance warning devices. The last pad should be placed a minimum of 250 feet (75 meters) in advance of the traffic condition.

A RUMBLE STRIPS sign (W8-H16) warning drivers of the onset of rumble strips may be placed in advance of any rumble strip installation.

Although the intent of the rumble strips is to alert the road user, the noise may also attract the attention of non-road users on adjacent property. This would be unacceptable in residential areas.

605-18 Screens

Screens **(see OMUTCD Section 6F.79)** are used to block the road users' view of activities that can be distracting. Screens might improve safety and motor vehicle traffic flow where volumes approach the roadway capacity because they discourage gawking and reduce headlight glare from oncoming motor vehicle traffic. They can also help contain the work area and reduce the accumulation of dust and debris on the pavement.

On **ODOT**-maintained highways a glare screen shall be used at all crossover locations.

The upper portion of the 50-inch (1270-millimeter) portable concrete barrier (PCB) serves as a glare screen (see **SCD RM-4.1** for details).

Paddle, or intermittent, type glare screens may be mounted on the top of 32-inch (810-millimeter) PCB.

See ***Section 642-21*** **(Plan Note 642-21)**, **L&D Manual Volume One, Section 604** and **SCD MT-95.70** for additional guidance.

The choice of 32-inch (810-millimeter) PCB, with screen, or 50-inch (1270-millimeter) is often left to the contractor.

Glare screen can be a maintenance problem. If PCB will be in place over the winter during plowing operations, or if the PCB is otherwise expected to be hit a lot, the 50-inch (1270-millimeter) PCB should be specified. Plowing over the top of a 50-inch (1270-millimeter) PCB is possible; however, it is not preferred.

605-19 Barrier Reflectors and Object Markers

As noted in ***Section 605-14.4.2***, barrier reflectors shall be mounted on all PCB on **ODOT**-maintained highways, and barrier object markers shall be mounted on all 32-inch (810-millimeter) PCB. They may also be used on other temporary traffic barriers.

The minimum reflective surface area for the reflector portion of a barrier reflector should be 7 square inches (4500 square millimeters).

The reflectors shall be mounted on the face of the barrier with the top of the reflector approximately 26 inches (650 millimeters) above the base and at a maximum spacing of 50 feet (15.2 meters).

Attachment of the reflector shall be by a suitable corrosion resistant fastener, bracket or adhesive.

Barrier reflectors shall be the same color as the adjacent edge line. When adjacent to a reversible traffic direction lane, yellow and white reflectors shall be paired back-to-back.

Barrier Object Markers shall be 6 inches (150 millimeters) wide and at least 12 inches (300 millimeters) high. They shall have orange (fluorescent red-orange or fluorescent yellow-orange) retroreflectorized sheeting. If used with two-way traffic, back to back markers shall be used.

Barrier object markers shall be mounted on the top of the PCB. The markers are spaced at 50 foot (15.2 meters) maximum centers midway between the face-mounted reflectors. When adjacent to a reversible traffic direction lane or between opposing traffic flows, they shall be mounted in pairs facing traffic from each direction.

605-20 Future and Experimental Devices

As noted in **OMUTCD Section 6F.80**, the **States**, **FHWA**, **AASHTO**, the **Transportation Research Board (TRB)**, and other organizations conduct research and experimentation on new traffic control and safety devices.

The **TEM** may be used to distribute information on experimental devices that have been approved for use, and on new devices that have yet to be incorporated into the **OMUTCD**.

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606 TYPE OF TEMPORARY TRAFFIC CONTROL ZONE ACTIVITIES

606-1 General

Each temporary traffic control zone is different. Many variables, such as location of work, road type, geometrics, vertical and horizontal alignment, intersections, interchanges, road user volumes, road vehicle mix (buses, trucks, and cars), and road user speeds affect the needs of each zone. The goal of temporary traffic control in work zones is safety with minimum disruption to road users. The key factor in promoting temporary traffic control zone safety is proper judgment.

Previous sections in this chapter have reviewed general policies, standards and guidelines regarding temporary traffic control zones and the related devices. ***Tables 697-1a through 697-1f*** provide a review of various options available in choosing the appropriate temporary traffic control. ***Section 606*** provides a general discussion about various types of temporary traffic control activities. The following major section ***(Section 607)*** and **OMUTCD Chapter 6H** provide more detailed guidelines about specific typical applications of temporary traffic control. ***Sections 640, 641, 642 and 643*** include additional information intended to aid in preparing Temporary Traffic Control (Maintenance of Traffic or MOT) Plans.

The discussion in this section regarding types of temporary traffic control activities has been organized into the same general categories used in **OMUTCD Chapter 6G**:

1. Work Duration.
2. Location of the Work.
3. Modifications to Fulfill Special Needs.
4. Work Outside of the Shoulder.
5. Work on the Shoulder with No Encroachment.
6. Work on the Shoulder with Minor Encroachment.
7. Work Within the Median.
8. Work Within the Traveled Way of Two-Lane Highways.;
9. Work Within the Traveled Way of Urban Streets.
10. Work Within the Traveled way of Multilane, Nonaccess Controlled Highways.
11. Work Within the Traveled Way at an Intersection.
12. Work Within the Traveled Way of Expressways and Freeways.
13. Two-Lane, Two-Way Traffic on One Roadway of a Normally Divided Highway.
14. Crossovers.
15. Interchanges.
16. Movable Barriers.

606-2 Typical Applications

The typical applications of temporary traffic control zones addressed in the **OMUTCD** and this chapter are organized according to duration, location, type of work and highway type. **OMUTCD Table 6H-1** and the Figures Index for this chapter ***(Section 698)*** provide listings of the typical applications shown in these manuals. These typical applications address the use of various temporary traffic control methods, but do not include a layout for every conceivable work situation.

Typical applications for which **Traffic SCDs** have been prepared are discussed in ***Section 641***.

The typical applications should be modified, as necessary, to fit the conditions of a particular temporary traffic control zone. Other devices may be added to supplement the devices shown in the typical applications, while others may be deleted. The sign spacings and taper lengths may be increased to provide additional time or space for driver response.

Decisions regarding the selection of the most appropriate typical application to use as a guide for a specific temporary traffic control zone require an understanding of each situation. Although there are many ways that work zone applications could be categorized, four factors are used in this chapter to generally characterize the typical applications addressed in ***Section 607*** and **OMUTCD Chapter 6H**. Those four factors are: work duration, work location, work type and highway type.

606-3 Work Duration

As noted in **OMUTCD 6G.02**, work duration is a major factor in determining the number and types of devices used in temporary traffic control zones. The duration of a temporary traffic control zone is defined relative to the length of time a work operation occupies a spot location.

OMUTCD 6G.02 establishes the following five categories of work duration and discusses each one:

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

2. Intermediate-term stationary is work that occupies a location more than one daylight period up to three days, or nighttime work lasting more than one hour.

3. Short-term stationary is daytime work that occupies a location for more than one hour, but less than twelve hours.

4. Short duration is work that occupies a location up to one hour.

5. Mobile is work that moves intermittently or continuously.

606-4 Location of Work

As noted in **OMUTCD 6G.03**, the choice of temporary traffic control needed for a temporary traffic control zone depends upon where the work is located. As a general rule, the closer the work is to road users, the greater the number of temporary traffic control devices that are needed. Procedures are described in **OMUTCD Chapter 6G** and herein for establishing temporary traffic control zones in the following locations:

1. Outside the shoulder;

2. On the shoulder with no encroachment;

3. On the shoulder with minor encroachment;

4. Within the median; and

5. Within the traveled way.

606-5 Modifications To Fulfill Special Needs

The typical applications in **OMUTCD Chapter 6H** and herein illustrate commonly encountered situations in which temporary traffic control devices are employed. Supplemental information provided in this **TEM** chapter should also be consulted to insure compliance with **ODOT** standards. Other devices may be added to supplement the devices indicated in these figures. Device spacing may be adjusted to provide additional reaction time. When conditions are less complex than those depicted in the typical applications, fewer devices may be needed.

When conditions are more complex, typical applications should be modified by incorporating appropriate devices and practices from the list provided in **OMUTCD Section 6G.04**.

Temporary traffic barriers serving as temporary traffic control devices shall conform to requirements for such devices as set forth throughout **OMUTCD Part 6** and this chapter.

606-6 Work Outside of Shoulder

When work is being performed off the roadway (beyond the shoulders, but within the right-of- way), little or no temporary traffic control may be needed. See **OMUTCD Section 6G.05 and Figure 6H-1** for information on this situation.

In these situations, a single Warning Sign, such as SHOULDER WORK AHEAD (W21-H5), should be used. If the equipment travels on the roadway, the equipment should be equipped with appropriate flags, rotating/strobe lights, and/or a SLOW MOVING VEHICLE symbol.

If work vehicles are on the shoulder, a SHOULDER WORK AHEAD sign may be used. For mowing operations, the MOWING AHEAD sign (W21-H8) may be used. Where the activity is spread out over a distance of more than 2 miles (3.2 kilometers), the SHOULDER WORK AHEAD sign may be repeated every 1 miles (1.6 kilometers). A supplementary plaque with the message NEXT X MILES plate (W7-3a) may be used.

606-7 Work on the Shoulder with No Encroachment

Generally, when a highway shoulder is occupied or closed a SHOULDER WORK AHEAD sign (W21-H5) or the RIGHT (LEFT) SHOULDER CLOSED sign (W21-5a) is used. See **OMUTCD Section 6G.06 and Figures 6H-3, 6H-4 and 6H-5**.

When the shoulder is not occupied, but work has adversely affected its condition, the LOW SHOULDER (W8-9) or SOFT SHOULDER (W8-4) sign should be used, as appropriate. Where the condition extends over a distance in excess of 1 mile (1.6 kilometer), the sign should be repeated at 1-mile (1.6-kilometer) intervals.

When used for shoulder work, arrow panels shall operate only in the caution mode.

606-8 Work on the Shoulder with Minor Encroachment

OMUTCD Section 6G.07 and Figure 6H-6 address situations where work on the shoulder encroaches slightly into the traveled way.

606-9 Work Within the Median

As noted in **OMUTCD Section 6G.08**, if work in the median of a divided highway is within 15 feet (4.5 meters) of the edge of the traveled way for either direction of travel, temporary traffic control should be used through the use of advance Warning Signs and channelizing devices.

606-10 Work Within the Traveled Way of Two-Lane Highways

Techniques for controlling motor vehicle traffic under one-lane, two-way conditions are described in **OMUTCD Section 6G.10** and ***Section 602-7***. For the **ODOT**-maintained system, the techniques most often are:

1. Flaggers **(see OMUTCD Figure 6H-10 and SCDs MT-97.10 and 97.11)**;

2. Temporary traffic control signal **(see OMUTCD Figure 6H-12, *Section 607-13*, SCDs MT-96.10, 96.11, 96.21, 96.25 and 96.26, and various Traffic PISs)**.

However, in low-volume situations STOP/YIELD sign control **(see OMUTCD Figure 6H-11 and *Section 607-12*)** may be considered.

Detour signs are used to direct road users onto another roadway. At diversions, road users are directed onto a temporary roadway or alignment placed within or adjacent to the right-of-way. Typical applications for detouring or diverting road users on two-lane highways are shown in **OMUTCD Figures 6H-7, 6H-8 and 6H-9.**

606-11 Work Within the Traveled Way of Urban Streets

In urban temporary traffic control zones, decisions are needed on how to control motor vehicle traffic, such as how many lanes are required, whether any turns should be prohibited at intersections, and how to maintain access to business, industrial and residential areas. See **OMUTCD 6G.10**.

If the temporary traffic control zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided. ***Section 603***, and **OMUTCD Figures 6H-28 and 6H-29** contain additional information regarding controlling pedestrian movements near work zones.

If the temporary traffic control zone affects the movement of bicyclists, adequate access to the roadway, bicycle paths or shared-use paths shall be provided. If a designated bicycle route is closed because of the work being done, a signed alternate route should be provided. Bicyclists should not be directed onto the path used by pedestrians. Additional information on bikeways may be found in **OMUTCD Part 9**, ***Part 9*** of this Manual, the **Guide for the Development of Bicycle Facilities** and from the **Office of Local Projects**.

606-12 Work Within the Traveled Way of Multilane, Nonaccess Controlled Highways

Work on multilane highways can be divided into right-lane closures, left-lane closures, interior-lane closures, multiple-lane closures and closures on five-lane roadways. These situations are addressed in **OMUTCD Section 6G.11 and Figures 6H-30, 6H-31, 6H-32, 6H-33, 6H-34, 6H-35 and 6H-37**. Related **Traffic SCDs** are discussed in ***Section 641***.

When a roadway must be closed on a divided highway, a median crossover may be used ***(see Section 606-16)***.

606-13 Work Within the Traveled Way at an Intersection

The typical applications for intersections are classified according to the location of the work space with

respect to the intersection area (as defined by the extension of the curb or edge lines). The three classifications are near side, far side and in-the-intersection. Work spaces often extend into more than one portion of the intersection. For example, work in one quadrant often creates a near-side work space on one street and a far-side work space on the cross street. In such instances, an appropriate temporary traffic control plan is obtained by combining features shown in two or more of the intersection and pedestrian typical applications. **OMUTCD Section 6G.12 and Figures 6H-21 through 6H-27** address work within the traveled way at an intersection.

606-14 Work Within the Traveled Way of Expressways and Freeways

Temporary traffic control problems might occur under the special conditions encountered where motor vehicle traffic must be moved through or around temporary traffic control zones on high-speed, high-volume roadways. Although the general principles outlined in the **OMUTCD** and previous sections of this Manual are applicable to all types of highways, high-speed, access-controlled highways need special attention in order to safely and efficiently accommodate motor vehicle traffic while also protecting workers. See **OMUTCD Section 6G.13 and Figures 6H-33 and 6H-35 through 6H-37** for information on this type of work.

Traffic SCDs have also been developed to address lane closures on freeways and expressways. Lane closure procedures are discussed in ***Section 641***.

Also see **Policy 516-003 (P) Traffic Management in Work Zones - Interstate and Other Freeways**.

OMUTCD Table 6C-2 provides information on the length of the merging and shifting tapers. Taper rates for shifts are also addressed in ***Section 602-5.3.***

606-15 Two-Lane, Two-Way Traffic on One Roadway of a Normally Divided Highway

OMUTCD Section 6G.14 addresses work involving two-lane, two-way traffic on one roadway of a normally divided highway.

OMUTCD Figure 6H-39 addresses the procedure for two-lane, two-way operation. Treatments for entrance and exit ramps within the two-way roadway segment of this type of work are shown in **OMUTCD Figures 6H-40 and 6H-41.** Related **Traffic SCDs** are discussed in ***Section 641***.

606-16 Crossovers

Crossover construction refers to the concept of maintaining two-way traffic operation on one side of a divided highway while the contractor performs work on the other side of the roadway. See **OMUTCD 6G.15 and Figure 6H-39**. As noted in ***Section 641-9.2***, design of crossover roadways is also addressed in ***Section 640-12 and Figures 698-6 through 698-9***. There is also additional information on this work in ***Sections 607-12 and 607-13*** **and SCDs MT-95.70 and 99.31**.

One disadvantage of crossover construction is that in order to provide entrance and exit ramp access in the direction of travel of the shifted traffic, temporary pavement will be necessary at each interchange. Crossover construction is most beneficial on projects where ramp access is not mandatory. For further information on the advantages and disadvantages of crossover construction, see the compendium of options presented in ***Tables 697-1a through 697-1f***.

606-17 Interchanges

Work in th area of interchanges on limited-access highways is addressed in **OMUTCD 6G.16 and Figures 6H-40 through 6H-44**. Additional information is also provided in ***Sections 607-13 through 607-15***, ***Figures 698-4 and 698-5***, and the **SCD MT-98 series**.

606-18 Movable Barriers

OMUTCD Section 6G.17 and Figure 6H-45 address a temporary reversible lane using movable barriers.

606-19 Work in the Vicinity of Highway-Rail Grade Crossings

OMUTCD Section 6G.18 addresses work in the vicinity of highway-rail grade crossings.

606-20 Control of Traffic Through Incident Areas

OMUTCD Section 6G.19 addresses control of traffic through incident areas. More information on the development of guidelines for **ODOT** in this area are also available by contacting the **OTE Maintenance of Traffic Section or the OTE Standards Section**.

607 TYPICAL APPLICATIONS

607-1 General

Section 606 presented a general discussion of typical temporary traffic control activities. ***Section 607*** provides more detailed information about typical applications for a variety of situations commonly encountered.

Temporary traffic control applications are presented in **OMUTCD Chapter 6H**, in this **TEM** chapter, and in the **SCD MT series**. Applications shown in the **OMUTCD** present minimum standards permitted within **Ohio**. Traffic control applications presented in the **SCDs** are intended for use on **ODOT** administered projects, and are more restrictive than the applications presented in the **OMUTCD**. As noted in ***Section 600-3***, applicable **SCDs** are also recommended for use in **ODOT** force-account work as much as practical. Additional guidance in proper application of temporary traffic control devices is presented in **CMS 614**.

In addition to information in the **OMUTCD**, figures and tables found in this chapter provide information for the development of temporary traffic control plans. **OMUTCD Table 6C-2** is used for the determination of taper lengths, and **OMUTCD Table 6C-1** can be used for Warning Sign spacing for various areas and roadway types.

While not every situation is addressed, the information illustrated in the **OMUTCD** and in the **SCDs** can generally be adapted to a broad range of conditions. In many instances, an appropriate temporary traffic control plan is achieved by combining features from various typical applications. For example, work at an intersection might present a near-side work zone for one street and a far-side work zone for the other street. These treatments are found in two different typical applications, while a third typical application shows how to handle pedestrian crosswalk closures.

Procedures for establishing temporary traffic control zones vary with such conditions as road configuration, location of the work, work activity, duration of work, road user volumes, road vehicle mix (buses, trucks, and cars) and road user speeds. Examples presented in the **OMUTCD** are guides showing how to apply principles and standards. Applying these guidelines to actual situations and adjusting to field conditions requires judgment. In general, the procedures illustrated represent minimum solutions for the situations depicted.

Other devices may be added to supplement the devices shown in the various applications presented in these documents. Device spacing may be adjusted to provide additional reaction time or delineation. Fewer devices may be used based on field conditions.

The legend for the symbols used in typical applications presented in the **OMUTCD** and this Manual are provided in **OMUTCD Table 6H-2**. In many of the typical applications, sign spacings and other dimensions are indicated by letters using the criteria provided in **OMUTCD Table 6C-1**. Most of the typical applications show temporary traffic control devices for only one direction.

The following are general comments regarding the use of **OMUTCD** typical applications for **ODOT** work:

1. References to “activated rotating lights or strobe lights” shall be interpreted as “activated rotating yellow lights or strobe lights visible for one-quarter mile (0.4 kilometer).”

2. The Construction Arrow sign (W1-H8a) may be used instead of the arrow panel for lane closures on low-volume, low-speed roads and urban streets. The Construction Arrow sign may be used to supplement the arrow panel on high-volume roads.

3. Traffic control signing for lane closure on multilane highways may be supplemented by Changeable Message Signs.

4. In long-term situations, additional advance Warning Signs may be desirable.

5. Concrete barrier is one method that may be used to close a lane for a long-term project. Use of a barrier should be based on the need determined by an engineering analysis. The layout of the barrier should prevent vehicles from impacting the ends of the barrier. According to the **Roadside Design Guide (RDG)** ***(Section 193-12)***, the barrier should be flared beyond the clear zone. An alternative procedure is to place an impact attenuator to protect traffic from the end of the barrier ***(see Section 605-14)***.

6. Where ramps exist within the limits of the project, the EXIT OPEN, EXIT OPEN AHEAD, EXIT CLOSED, AND EXIT CLOSED AHEAD signs shall be provided, as shown in the **SCD MT-98** series.

7. Where entrance ramps are located within the project limits and the mainline gaps are insufficient to provide proper merging, consideration should be given to closing the ramps.

607-2 Blasting Zone (OMUTCD Figure 6H-3)

On a divided highway, the signs should be mounted on both sides of the directional roadways.

607-3 Road Closed with Off-Site Detour (OMUTCD Figure 6H-8)

For unnumbered routes, the M4-9 DETOUR sign may be used instead of the M4-8 DETOUR sign.

607-4 Lane Closures on Low-Volume, Two-Lane Road (OMUTCD Figure 6H-11)

In long-term operations, a double-yellow No-Passing Zone should be added on the approach for the closed lane. The No-Passing zone shall have a length of "A" as determined from **OMUTCD Table 6C-1.**

607-5 Lane Closure on Two-Lane Road Using Traffic Signals (OMUTCD Figure 6H-12)

For high-volume applications, consideration should be given to installation of the BE PREPARED TO STOP sign (W3-4) in advance of the Signal Ahead sign (W3-3).

607-6 Temporary Road Closure (OMUTCD Figure 6H-13)

When the temporary road closure occurs at night, Type A flashing lights should be used on advance Warning Signs and the flagger station should be illuminated.

607-7 Detour for One Travel Direction (OMUTCD Figure 6H-19)

A DETOUR sign with an advance arrow (M4-H9b) may be used in advance of a turn. On multilane streets, a DETOUR sign with an advance turn arrow should be used in advance of a turn.

607-8 Right Lane Closure - Far Side of Intersection (OMUTCD Figure 6H-22)

For long-term operations, pavement markings may be used to highlight the right-only movement.

607-9 Mobile Operation on Multilane Road (OMUTCD Figure 6H-35)

Shadow vehicle 2 in this figure may be equipped with a truck-mounted attenuator.

607-10 Lane Shift on Freeway (OMUTCD Figure 6H-36)

Additional signing should be provided as shown in **SCD MT-102.10**. This signing includes the RIGHT (LEFT) LANE MUST USE SHOULDER sign (W20-H12) if use of the shoulder is involved and the ALL TRUCKS USE LEFT (RIGHT) LANE sign (W20-H10, W20-H11) if the shoulder cannot adequately accommodate trucks.

SCD MT-99.30 addresses additional requirements for delineation along lane shifts of 4 feet (1.2 meters) or more.

607-11 Interior Lane Closure on Freeway (OMUTCD Figure 6H-38)

This figure cannot be used on **ODOT** freeways as shown. For work on projects which include **ODOT** funding or administering, an adjacent lane shall also be closed. This adjacent lane may serve to give the contractor additional work space for equipment and work vehicles transportation, or it may serve as a lateral buffer.

607-12 Median Crossover on Freeway (OMUTCD Figure 6H-39)

This figure currently shows signing for closure of the right lane in advance of the crossover. A left-lane closing may be used instead. For example, signing for a left-lane closure with this treatment is shown in **SCD MT-95.70** ***(see Section 641-9)*****.**

Additional information in this Manual regarding crossovers is referenced in ***Section 606-16***.

607-13 Median Crossover for Entrance Ramp (OMUTCD Figure 6H-40)

OMUTCD Figure 6H-40 and ***Figure 698-4*** address traffic control for a median crossover to maintain access for an entrance ramp. Additional information in this Manual regarding crossovers is referenced in ***Section 606-16***. The following additional guidelines should be used with this application:

1. This typical application should be used for accessing an entrance ramp across a closed directional roadway of a divided highway.

2. The crossover shall be designed for each specific location and incorporated into the construction plans. A temporary acceleration lane that provides adequate Decision Sight Distance (DSD) for merging traffic should be provided. If the required DSD cannot be provided, consideration should be given to closing the ramp. See ***Table A*** in this section for the required Decision Sight Distance (DSD). Additional DSD information is available in **Figure 201-6 of the L&D Manual Volume One.**

   Should physical restrictions exist that preclude these minimums being provided, engineering judgement should be used to determine if a safe merging operation can be provided. Factors such as volumes, gap availability, sight distance, percent trucks, availability of alternate routes, and emergency access should be considered. It may be necessary to statutorily lower the main line speed to accommodate the merging traffic. Documentation should be kept on file supporting the decision to provide a merge with less than the below DSD. The use of the STOP (R1-1) or YIELD (R1-2) signs shown should only be considered when the required distances shown in ***Table A*** cannot be provided and it is impossible or impractical to close the entrance ramp.

3. A broken edge line may be carried across the temporary entrance ramp to assist in defining the through motor vehicle travel lane.

4. When a temporary traffic barrier is used to separate opposing motor vehicle traffic, the Two-Way Traffic signs (W6-3) and the DO NOT ENTER signs (R5-1) may be eliminated.

Table A - Decision Sight Distance

Posted Mainline Speed (mph)	Rural	Urban
45	675 feet	930 feet
55	865 feet	1135 feet
65	Diamond ramp = 1050 feet Loop Ramp = 1200 feet	1365 feet

607-14 Partial Exit Ramp Closure (OMUTCD Figure 6H-43)

An additional ROAD WORK AHEAD sign (W20-1) should be added if traffic backs up onto the mainline.

607-15 Work in Vicinity of Entrance Ramp (OMUTCD Figure 6H-44 and *Figure 698-5*)

OMUTCD Figure 6H-44 provides traffic control information for work in the vicinity of an entrance ramp. ***Figure 698-5*** depicts an alternative design that has been developed to provide additional geometric information pertaining to the required Decision Sight Distance (DSD) for long-term work zones. The following additional guidelines should be used with these figures:

1. The left diagram in **OMUTCD Figure 6H-44** can be used for both short and long -term work zones where it is acceptable to close the outside mainline lane.

2. The right diagram in **OMUTCD Figure 6H-44** should only be used for short-term operations where engineering judgment indicates that a safe merging operation can be provided. Factors such as volumes, gap availability, sight distance, percent trucks, availability of alternate routes and emergency access should be considered when deciding to provide this method of traffic control or closing the entrance ramp. It may be necessary to legally lower the mainline speed to accommodate the merging traffic.

3. When used, the YIELD sign (R1-2) shown in the right diagram of **OMUTCD Figure 6H-44**, should be located so that ramp motor vehicle traffic has adequate sight distance of oncoming mainline motor vehicle traffic to select a safe gap in the mainline motor vehicle traffic flow. Also. a longer acceleration lane should be provided beyond the sign to reduce the gap size needed. If insufficient gaps are available, consideration should be given to closing the ramp.

4. Where a mainline lane is closed, the closure should be sufficiently in advance to stabilize motor vehicle traffic flow before encountering the merge.

5. For **OMUTCD Figure 6H-44** the mainline merging taper with the arrow panel at its starting point should be located sufficiently in advance so that the arrow panel is not confusing to drivers on the entrance ramp, and so that the mainline merging motor vehicle traffic from the lane closure has the opportunity to stabilize before encountering the motor vehicle traffic merging from the ramp.

6. If the ramp curves sharply to the right, Warning Signs with Advisory Speed plates located in advance of the terminal should be placed in pairs (one on each side of the ramp).

7. Where the acceleration distance is significantly reduced, a supplemental plaque may be placed below the Yield Ahead sign (W3-2a) reading NO MERGE AREA (W23-H2).

8. ***Figure 698-5*** should typically be used when designing long-term on-ramp merges with a mainline work zone. See ***Table A*** in this section for the required Decision Sight Distance (DSD). (Additional DSD information is available in **Figure 201-6 of the L&D Manual Volume One**.) Should physical restrictions exist that preclude these minimums being provided, engineering judgment should be used to determine if a safe merging operation can be provided. Factors such as volumes, gap availability, sight distance, percent trucks, availability of alternate routes, and emergency access should be considered. It may be necessary to legally lower the mainline speed to accommodate the merging traffic. Documentation should be kept on file supporting the decision to provide a merge with less than the below DSD. The use of STOP (R1-1) and YIELD (R1-2) signs shown in the **OMUTCD** should only be considered when the required distances shown in Table A cannot be provided and it is impossible or impractical to close the entrance ramp.

Section 606-17 and **SCDs MT-98.15 and 98.16** provide additional traffic control information for this application.

Table A - Decision Sight Distance

Posted Mainline Speed (mph)	Rural	Urban
45	675 feet	930 feet
55	865 feet	1135 feet
65	Diamond ramp = 1050 feet Loop Ramp = 1200 feet	1365 feet

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620 MATERIALS AND HARDWARE

620-1 General

Many features along a roadway and particularly within work zones present an active hazard to the traveling public. These may be fixed objects, drop-offs, severe slopes, opposing traffic, construction materials and equipment, etc. In these instances, a positive means of separating traffic from these hazards must be employed. Portable concrete barrier, portable water-filled barrier, or guardrail are appropriate positive barriers for maintenance of traffic applications.

The use of these positive barriers must be carefully considered on non-freeway / expressway routes due to property access concerns.

620-2 Safety Criteria

620-2.1 National Cooperative Highway Research Program (NCHRP) 350 Criteria

Work zone safety features, including barriers and impact attenuators, installed on the **National Highway System (NHS)** must demonstrate satisfactory crashworthy performance to be accepted by **FHWA**. The dates for mandatory compliance vary with different types of equipment. The **NCHRP Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features** should be consulted in order to determine the compliance date for a particular item.

ODOT has determined that the **NCHRP 350** criteria shall apply to any **ODOT**-maintained highway regardless of whether or not the highway is on the **NHS**. The **NCHRP** safety criteria can be found on the **FHWA** web site under the Programs handled by the **Safety Section**, see ***Table 197-3***.

620-2.2 Other Safety Criteria

In addition to the **NCHRP 350** criteria, any work on **ODOT**-maintained highway shall meet the requirements of the **OMUTCD** and **TEM**.

Materials and equipment used on projects in the **State of Ohio** which are neither on the NHS nor on the state highway system must meet the criteria of the **OMUTCD**.

620-3 Sheeting

Faces of construction signs shall be reflectorized with Type G or Type H sheeting complying **with CMS 730.19** and **730.192**. The background color of all construction Warning Signs and all construction Guide Signs shall be fluorescent orange as per **CMS 614.03.** For information regarding sheeting on other signs, see ***Section 220.***

Standards for sheeting quality are provided in **ATSSA's Quality Standards for Work Zone Traffic Control Devices *(Section 695-4)***.

620-4 Temporary Sign Supports

Temporary sign supports shall meet **NCHRP 350** guidelines ***(Section 620-2)*** as well as the requirements of **SCDs MT-105.10 and MT-105.11**.

620-5 Roll-Up Signs

Roll-up signs shall conform to **ASTM D 4956 Type VI**, and shall be retroreflective fluorescent orange.

The wind resistant sign supports shall meet the crash testing requirements in the **NCHRP Report 350**, and be approved for use by **FHWA**.

620-6 Pavement Markings

620-6.1 General

Work zone pavement markings shall conform to **CMS 614.10.** Additional information on pavement markings in temporary traffic control zones is provided in **OMUTCD Section 6F.65** and ***Sections 605-11.10 and 605-11.11***.

620-6.2 Materials

Either **CMS 642** (temporary paint) or **CMS 740.06** (temporary tape) may be used on any surface which will either be removed or covered by another surface in a subsequent maintenance of traffic phase. Temporary pavement marking which would conflict with final traffic lanes shall be removable **CMS 740.06** (Type I tape).

620-6.3 Dimensions

The line dimensions shall be as specified in **CMS 614.10.** Line dimensions wider than those specified may be used in cases where increased delineation is necessary.

630 PLANNING / PROGRAMMING

630-1 General

The following sections are provided to assist planners and designers in the planning phase of a project or work assignment. For example, **Section 1400 of the L&D Manual Volume Three** indicates that a Maintenance of Traffic Alternative Analysis will be performed and that is addressed in ***Section 630-5***. Various tools that are available are also addressed herein and this information is intended to help in making the choice of which tool to use and how.

630-2 Compendium of Traffic Control Options

Tables 697-1a through 697-1f provide a summary of various traffic control strategies/options used to maintain traffic through work zones or to direct traffic around work zones, along with advantages and disadvantages of these strategies. These options should be reviewed in the initial stages of any project.

630-3 Detours

Because temporary traffic control is an essential part of the overall project design and can often affect the design of the facility itself, the decision to either maintain traffic on the existing facility or to utilize a detour must be made early in the planning process. Some of the items that should be considered are:

1. Type of project.
2. Length of project.
3. Duration of project.
4. Volume and type of traffic.
5. Availability of detours or alternate route.
6. Length and adequacy of detour route.
7. Anticipated delays/backups.
8. Geometric requirements.
9. Capacity of reduced-width roadways.
10. Effect on local activities and residents.
11. Construction techniques.
12. Pavement types.
13. Economics.
14. Bridge Limitations - width/height/weight.
15. Adequacy of adjacent highways for use as detours, and the prohibition of construction and maintenance work along the detours while in use.

16. Railroad Grade Crossings.

In general, projects with detours shorten construction time, are less expensive to construct, and are safer for construction personnel. On the other hand, maintaining traffic generally is more convenient for the user and has a less detrimental effect on local activities.

630-4 Permitted Lane Closure Maps (PLCM)

Lane closures on Interstate and other freeways shall meet the minimum criteria presented in **Policy 516-003(P)** ***(see Sections 601-2 and 1311)***.

On the basis of this policy, **ODOT** has developed a series of lane closure maps/schedules. These maps/schedules indicate the hours of the day in which a lane closure is permitted at a subject work zone location. Maintenance of traffic plans shall be in conformance with the permitted lane closure map/schedule (PLCM). Exceptions may be permitted, as discussed in the policy, based on results of a queue length study or by waiver from the **Multi-lane Coordinator (MLC)** ***(see Sections 601-2 and 1311)***.

If it is found that lane-closure requirements cannot be met at a reasonable cost at the subject work zone, the **District** has the option of applying to the **Multi-Lane Coordinator (MLC)** for a waiver or modification of the lane closure restrictions at the site. If such waiver is not approved, the maintenance of traffic plans shall be revised to meet the requirements of the PLCM.

The lane-closure schedule is available on the **OTE** web site at the following address: http://dotaw100.dot.state.oh.us/ plcm_web.jsp.

630-5 Maintenance of Traffic Alternative Analysis

As noted in ***Section 630-1***, **Section 1400 of the L&D Manual** indicates that a Maintenance of Traffic Alternative Analysis will be performed. This analysis shall be submitted during Step 6 for review and approval for any projects following the Major Plan Development Process (PDP). For projects following the Minor Plan Development Process, the analysis shall be submitted during step 3. However, for Minor PDP projects, only work zones on the Interstate or Interstate look-alike system need to be analyzed.

A Maintenance of Traffic Alternative Analysis shall address the following requirements:

1. For Non-Interstate Work Zones (Major Projects):

    a. Investigate maintenance of traffic for each alternative.

    b. Include an evaluation of maintenance of traffic for ramps, local roads and cross streets.

    c. For each alternative determine:

        i. Number of lane to be maintained.

        ii. Type of maintenance of traffic (i.e., signalized, detoured, part-width, runaround, crossover, etc.).

        iii. Lane widths.

        iv. Typical sections.

2. For Interstate and Interstate Look-alike Work Zones (Major and Minor Projects):

   a. Provide a stick drawing (schematic or sketch) covering the entire project length for the following two work zone alternatives:

      i. Part-width construction.

      ii. Crossover construction.

   b. Include on each stick diagram (schematic or sketch) the following information:

      i. Arrows showing lane use, including merging and diverging ramps in relation to work areas and barriers.

      ii. All bridges.

      iii. Cross/transverse sections between every interchange; on every bridge; at each merge and diverge point (ramps); and where overpass piers are present. Where bridge widths vary, show the narrowest part of the bridge.

      iv. Existing toe-toe bridge width; proposed final bridge toe-toe widths (if available); required toe-toe bridge widths necessary for maintenance of traffic. This may be in the form of a table if necessary.

   c. The following shall be used to create the cross/transverse sections in 2b:

      i. The number of lanes provided during construction will satisfy **ODOT's Policy 516-003(P), Traffic Management in Work Zones Interstate and Other Freeways *(see Sections 601-2 and 1311)***.

         The number of lanes required by this work zone policy is a starting point for the analysis. It is not meant to imply that a work zone policy exception will never be needed. In fact, ability to meet the work zone policy is one of the constraints that will be specifically examined in 2d. As noted in ***Sections 601-2 and 630-4***, the permitted lane closure maps (PLCM) on **ODOT's** web page define what hours a lane reduction is allowed on any segment of **Ohio's** Interstate and Interstate look-alike system. Any work zone that violates the PLCM will require a detailed queue analysis per the work zone policy and an exception request, if necessary, depending on the outcome of the queue analysis.

      ii. Typically show 11 foot (3.3 meter) lanes unless a narrower lane(s) provides significant benefits in terms of mitigating maintenance of traffic constraints as discussed in 2d. It is permissible to utilize a 10 foot (3 meter) lane(s) on bridges where insufficient space cannot provide for all lanes to be 11 foot (3.3 meter); however, the wider lanes are preferred whenever feasible.

      iii. All exit and entrance ramps will be maintained with the same number of lanes during construction as pre-construction.

      iv. A minimum 1 foot (0.3 meter) clearance will be provided between lanes and barrier toes.

      v. Show existing beam spacing on bridge decks (transverse sections).

      vi. Show bridge deck cut lines in relationship to existing beams (transverse sections).

      vii. Show a 2 foot (0.6 meter) paved shoulder where possible; and indicate locations where

this is not possible.

d. The following should be considered when looking for possible maintenance of traffic constraints for the two alternatives (part-width and crossover construction):

i. Ability to comply with **Policy 516-003(P)**.

ii. Ability to maintain all accesses.

iii. Ability to provide required on-ramp merge decision sight distance ***(Sections 607-13 and 607-15)***.

iv. Right-of-way impacts.

v. Environmental impacts.

vi. Final bridge widths.

vii. Significant impacts for construction duration and construction costs .

viii. Significant impacts to earthwork, retaining walls, pier clearances, profile differences, etc.

ix. Ability to maintain existing drainage and lighting systems.

x. Constructability and construction equipment access.

xi. Location of crossovers (e.g., Can crossovers be located near the project?).

It is not the intent of the Maintenance of Traffic Alternative Analysis to require a detailed design of each alternative's work zone. It is intended to identify and compare major potential functional faults of the work zone alternatives.

For Major and Minor projects involving Interstates and Interstate look-alikes, this is accomplished by examining the impacts of the standard cross/transverse section provided in 2c of this section at the locations required in 2b. The impacts (constraints) the designer should be looking at are noted in 2d. This process should be followed for all phases of both the part-width and crossover scenario.

Should the part-width and crossover alternatives prove to have significant maintenance of traffic constraints, or prove impractical or otherwise not possible to construct, **ODOT** may require an additional analysis using a contra-flow technique to maintain traffic. Contra-flow is a hybrid design where one or more lanes are crossed over to the opposing directional lanes while maintaining one or more lanes on their normal directional side of the facility.

The Maintenance of Traffic Alternative Analysis may be a factor in choosing the preferred alternative and will serve as the basis for scoping the project's work zone design. The analysis should be a comparison of alternatives that documents maintenance of traffic constraints. It should address the benefits and problems between the alternatives, and should include the design team's recommendation on the preferred type of maintenance of traffic.

The analysis shall be submitted concurrently to the **District**, the **Central Office Multi-lane Coordinator** and the **Office of Traffic Engineering**. The analysis should always include a project description indicating the type of work. For Non-Interstate Work Zones (Major Projects only) the information required in item 1 of this section shall also be provided. For Interstate and Interstate Look-alike Work Zones, the following shall be included in the submission:

- **Stick Diagrams and Cross/Transverse Sections.** Stick diagrams (schematic or sketch) for the entire project length. The cross/transverse sections required in 2b and 2c of this section should be included. Location of the cross/transverse sections to be provided is noted in 2b.

- ***Form 696-1, Work Zone Constraints and background information***. This form shall be incorporated into the analysis report. The content of each box in the form should indicate if that work zone constraint will be an issue with that alternative (part-width or crossover). Where a constraint is identified, it should be clear which phase of construction (or all phases) the constraint will be present.

  Where a constraint is identified in ***Form 696-1***, it should be footnoted and an explanation should be provided after the table/form in the analysis report. The explanation should provide sufficient information for **ODOT** to determine the magnitude of the constraint.

  The following are some examples of constraint footnoted information. These are not meant to be all inclusive, nor are they intended to be an indication of verbatim responses expected. It is expected the engineering team will use judgment and provide sufficient information to allow **ODOT** to make an informed decision when selecting between alternatives.

  Crossover Construction Will Impact R/W - The explanation should state the project ramifications of overcoming this constraint (e.g., buy R/W or use retaining walls). Cost and/or schedule impacts should be included.

  Bridge Widths - In order to provide the number of lanes required by the work zone policy, existing structures will have to widened (either temporarily or permanently). For consistent cost estimating purposes, an amount of $30/sf should be used for temporary decking (when proposed beams and substructure can be utilized), or $100/sf where all new support and substructure will have to be used solely for maintenance of traffic. Project-specific cost estimating numbers may be used for unusual circumstances; however, when used, the new values should be plainly provided in the report.

  Ability to Provide Required On-Ramp Merge Decision Sight Distance - An existing ramp cannot provide adequate merge distance due a physical constraint, such as a bridge pier or parapet. Costs should be provided to remove the obstruction(s). In addition, information should be provided to indicate the extent to which the merge condition will not be satisfied (i.e., how many feet).

  Environmental Impacts - Crossover construction will require significant amounts of fill material that could introduce stream impacts. Project cost and schedule impacts should be provided.

  Ability to Meet Work Zone Policy - A long structure on the project will not allow for the work zone policy required number of lanes to be provided. Information should give an estimated cost to widen the structure to provide the required cross/transverse sections required in 2c. (The actual decision to widen the bridge would be made via a maintenance of traffic exception request if authorized by the **District**.)

  Construction Costs - A best available engineering estimate should be provided for each alternative. Major cost differences between alternatives should be noted (e.g., requires additional PCB and temporary pavement; requires widening bridge decks; requires purchase of additional R/W, etc.)

  Ability to Maintain Existing Lighting and Drainage Systems - Median-mounted highway lighting will have to be removed to accommodate maintenance of traffic, or proposed

alternative cross section will require temporary wedging to allow for drainage. Cost information should be provided.

The Maintenance of Traffic Alternative Analysis shall include a summary that includes a recommendation on alternatives based upon the constraints identified. It is not the responsibility of the design team to determine if one alternative is not feasible and therefore should not be analyzed. The alternatives should be analyzed and the information included in the report. **ODOT** will determine, based upon the analysis, which is the preferred alternative.

630-6 Conceptual Maintenance of Traffic

As noted in ***Section 140-7***, **Section 1400 of the L&D Manual** requires that a Maintenance of Traffic Conceptual Plan be submitted as part of the project development. This plan shall be based on the preferred alternative determined by **ODOT** after reviewing the Maintenance of Traffic Alternative Analysis ***(see Section 630-5)***.

The Maintenance of Traffic Conceptual Plan should include a stick drawing (schematic or sketch) of the preferred alternative covering the entire project. The drawing should include some, if not all, of the information listed in ***Section 630-5(2b)*** and the information in ***Section 630-5(2c)*** shall be used to create the cross/transverse sections.

640 DESIGN INFORMATION

640-1 General

The goal of any maintenance of traffic strategy should be to safely route traffic through or around a construction area while providing room for the contractor to work effectively. Ideally this should be done while keeping the geometrics and traffic control as close to those for normal operating conditions as possible. This frequently requires the engineer to balance the needs of the contractor to construct the project with the needs of the traveling public to minimize delay, maintain safety and maximize cost-effectiveness. In order to adequately serve both the contractor and the traveling public, various maintenance of traffic strategies should be analyzed before determining the final strategy. These plans should have some built-in flexibility to accommodate delays or unforeseen changes in the work schedule, field conditions or traffic patterns. The impact on land owners must also be considered.

This section provides guidelines and references used in designing the maintenance of traffic portion of a highway construction plan. If traffic is to be maintained on the existing facility during construction, the construction plan should include a Traffic Control, or Maintenance of Traffic, Plan that references the related **SCDs** and shows details, notes, sequences, procedures, limitations, equipment, materials and other items required to maintain traffic. ***Section 641*** provides additional design information related to specific typical applications and **SCDs**. Standard **Plan Notes** for temporary traffic control items are provided in ***Section 642.***

Capacity constraints are vital considerations in preparing Maintenance of Traffic Plans. In the following sections, capacity constraints are discussed for various types of facilities. The traffic volumes used in each discussion of capacity are maximum values for which the corresponding lane closures can be used. Where traffic exceeds the constraining volumes, consideration should be given to limiting work to non-peak hours, establishing alternate routes or using the shoulder as a traffic lane. See other appropriate sections, including ***Section 630-4*** (Permitted Lane Closure Maps/Schedule), for further discussion on these considerations.

The designer must use engineering judgment in combining these guidelines with site-specific conditions to create a safe and efficient work zone environment.

L&D Manual Volume Three, Section 1306 also provides the designer some guidance in developing a set of Maintenance of Traffic plans.

640-2 Geometrics

The following discussion of geometrics should be used as a guide where maintenance of traffic is to be accomplished using the existing facility. Geometric criteria to be used in designing and utilizing temporary roads is discussed in ***Section 640-11***.

It is desirable to maintain lane widths equal to those on the existing facility. A reduction in the lane width will result in a reduction in lane capacity. The desired lane width on freeways and expressways is 12 feet (3.6 meters). A 1.5 foot (0.45 meter) clearance from the edge line to the channelizing devices is also desirable.

If lane width reduction on freeways and expressways is necessary, it is desirable to maintain a minimum width of 11 feet (3.3 meters). Widths should not be less that 10 feet on any highway unless the lane widths on the existing facility are less than 10 feet (3 meters). In no case shall the lane width be less than 9 feet (2.7 meters). See ***Table 697-4*** for required lane widths when the degree of curvature exceeds 10 degrees (horizontal curve radius is less than or equal to 500 feet (150 meters)).

Channelizing device offsets, discussed in ***Sections 605-11.2***, should be provided in addition to lane

widths whenever possible. Attempts to provide larger offsets should be made whenever possible.

On spot improvement locations of very short length, such as bridge replacements or bridge reconstruction, (excluding Interstates and other freeways) where the clear roadway width (face to face of barrier or channelizing device) criteria stated above cannot be provided and a detour is not feasible, lateral clearance requirements to barriers and channelizing devices may be reduced. However, at no time on such a project shall the distance face-to-face of barrier and/or channelizing devices be less than 10 feet (3 meters). See **Table 697-4** for requirements on sharp curves (greater than 10 degree curve (curve radius is less than or equal to 150 meters)).

Where the horizontal alignment is to be altered from that of the existing roadway, the maintenance of traffic horizontal alignment shall conform to the criteria in **L&D Manual Volume One, Sections 202.1 and 202.2**. The designer should also ensure that the minimum stopping sight distance criteria in **L&D Manual Volume One, Section 201.2** and vertical clearances from **L&D Manual Volume One, Section 302.1** are satisfied.

640-3 Sequence of Operation

The maintenance of traffic notes should include a sequence of construction activities to coordinate the maintenance of traffic details, especially on complex projects. The sequence should include any planned stages, phases or steps as well as particular procedures if appropriate.

A stage typically identifies a period in which work is concentrated in one section of the project site. Each stage may appear as a separate construction project, as the work in one section of the project site is completed before the work in another section of the site is begun. Consideration should be given to relocating advance Warning Signs with each change of stages. Stages of construction may be separated by periods of inactivity. As is the case, if the contractor is required to complete one stage by the end of one construction season, and is not permitted to begin the next stage until the beginning of the next construction season. Implementation of multi-stage construction is typically limited to large projects.

A phase typically identifies the duration of a specific traffic control set up. That is, at the point in time when one phase is ended and another phase is begun, a change in traffic control set up is involved. On freeway upgrading or resurfacing projects, the first phase often calls for traffic to be maintained on existing pavement while the shoulder is being improved for use as a travel lane in later phases. The final phase often calls for traffic to be maintained on the final pavement surface while miscellaneous work is being completed beyond the shoulder.

A step typically identifies a sub-phase. Often it becomes necessary to make modifications to the traffic control set up in one location within the project while the set up in general remains unchanged. There may be a small change in the construction activity taking place in one location, there may be a change in the location of the activity or the change in traffic control set up might be temporary. Any of these could be considered as an individual step if the designer finds a need for specifically identifying the set up.

On complex, multi-year Maintenance of Traffic Plans consideration may be given to identifying project stages, phases and/or steps.

640-4 Lane Closure

Roadway construction often requires a reduction in the number of available lanes. This may require only a reduction in lane width or it may require complete lane closure. Lane closure may be required not only of the lane in which the activity is taking place, but also an adjacent lane in order to provide a barrier or a buffer between the workers and the motor vehicle traffic.

When there is a need to perform roadway maintenance or reconstruction in the interior lane of a freeway, an adjacent lane shall be closed in addition to the lane in which the maintenance or reconstruction is necessary. This additional lane may serve to provide access to construction traffic or equipment or it may serve as a lateral buffer. Reference is made to **OMUTCD Figure 6H-38, (Interior Lane Closure on Freeway)**. Caution is advise in the use of this figure. This figure may be used to determine proper signing for splitting directional through movement, however it does not provide for closure of the additional lane. Interior lane closure on **ODOT** projects shall be modified accordingly.

Before incorporating lane closures into the design of the Maintenance of Traffic Plan, the effect of the lane closure on the traffic flow must be analyzed to insure that delay to the road users is kept within an acceptable range ***(see Section 640-13)***.

A minimum distance between adjacent lane closures should be provided. Suggested minimum distances are 2 miles (3 kilometers) in high-volume locations and 1 mile (1.5 kilometers) in low-volume locations. If the suggested distance cannot be provided, it is suggested that the lane closure be extended between the adjacent locations to form one continuous lane closure.

640-5 Use of Shoulders

640-5.1 General

Many maintenance of traffic situations require the use of either the full width or part-width of the paved shoulder as a traffic lane. Capacity, traffic characteristics, bridge width, work area location and existing shoulder characteristics all play a role in determining the extent of modifications and use of paved shoulders.

Any shoulder use for maintaining traffic requires evaluating the integrity of the shoulder pavement. Engineering judgment should be used in making this evaluation. The designer should consider the percentage of truck traffic and the existing pavement condition, including the composition.

Examples of the shoulder used as a traffic lane are shown on **SCDs MT-102.10 and MT-102.20.**

640-5.2 Provisions for Use of Shoulders

When a shoulder is to be used as a traffic lane certain provisions shall be made:

1. Lane width, in accordance with ***Section 640-2***, shall be maintained. This may require widening the existing shoulder.

2. The designer shall evaluate the strength of the shoulder and consider strengthening it or replacing it with temporary pavement.

    1. Shoulders used for maintaining traffic, which are determined to be of insufficient strength, should be completely removed and replaced in accordance with the requirements of **L&D Manual Volume One, Section 301.2** and the **Pavement Design Manual *(Section 194-11)***.

    2. Shoulders used for maintaining traffic, which are determined to be structurally sufficient, should also provide smooth travel. Provisions should be made to recondition shoulder surfaces that are rutted, raveled or otherwise insufficient.

3. The designer shall examine structures to ensure that sufficient width and height are maintained.

4. The designer should evaluate the roadside for obstacles which may require protection. Temporary protection may be required at obstructions that were not previously protected. In such a situation the clear zone values for the facility under normal conditions **(L&D Manual Volume One, Figure 601-1)** may be reduced by 12 feet (3.6 meters), but shall never be reduced to less than 2 feet (0.6 meter).

During any sequence of operations where traffic is to be maintained within 2 feet (0.6 meters) of the edge of the paved shoulder, the graded shoulder area adjacent to the paved shoulder should be considered for strengthening. A bituminous aggregate base placed 8 inches (200 millimeters) deep, or a composition with similar structural characteristics, should be specified for 2 feet (0.6 meters) beyond the edge of the temporary traveled lane. This treatment should be placed in conjunction with final graded shoulder treatments when such shoulder use is required on final surface course pavements This treatment may be left in place.

Part-width use of shoulders may be required when either work or channelizing devices encroach upon the traveled lane adjacent to the shoulder.

640-5.3 Emergency Pull-Offs

When shoulders are used to maintain traffic over long distances, consideration should be given to providing emergency pull-offs in an attempt to minimize capacity reduction due to vehicle malfunction. This is particularly important when traffic is limited to only one lane in each direction. Signing for such pull-offs shall be erected in order to provide advance notice to the road user of the emergency pull-offs. These signs should be rectangular in shape, with black legend on orange background.

640-5.4 Existing Rumble Strips on Shoulders

Permanent, longitudinal rumble strips are often provided on freeway shoulders to alert the road user who diverts from the travel lane. Longitudinal rumble strips create a dilemma when providing lane-shifts in temporary traffic control zones. It may be necessary to remove or resurface longitudinal rumble strips when providing lane shifts. Or, if the temporary lanes can be aligned such that the wheels of the vehicles can straddle the rumble strip, it may be adequate to limit the rumble strip removal to the shift tapers.

640-6 Work Zone Drop-Offs

A pavement edge drop-off occurs when there is a vertical difference in height between adjacent road surfaces. Treatments for pavement edge drop-offs in construction work zones are shown on **Traffic Plan Insert Sheet 2010190**. The drawing may be used as a designer's tool for determining the appropriate measures to specify in the plans for treatment or protection of drop-off conditions. The designer may also use it to develop designs or sequences of operations that would avoid or minimize drop-offs.

The treatments indicated on the **Plan Insert Sheet** are intended for high-volume projects. For low-volume situations, a one-level drop in protection may be used, e.g., use drums instead of PCB. For low-speed situations, protection may not be needed. In all situations, engineering judgment should be used to select the most appropriate treatment for each work zone.

Maintenance of traffic **Plan Notes** should address the treatment of any anticipated open trench areas. Whenever possible, it should be stipulated that trench excavating operations will not remove any more material than can be replaced by the end of each day's work. In areas where this is not possible, or where adverse conditions prevent it, overnight trench openings shall be temporarily backfilled. See **Plan Notes 642-14 and 642-15** in ***Part 642*** for additional information.

640-7 Ramp Closure

640-7.1 Volume Considerations

In urban areas, consideration may be given to closing some entrance ramps. This can reduce the volume of traffic using the highway and to minimize the negative effect on mainline traffic capacity caused by the ramp traffic merging onto the highway. Such closures could significantly improve traffic flow on the freeway; however, detours must be provided on the surface street system to handle the diverted traffic volume.

640-7.2 Geometric Considerations

Geometric conditions on ramps often make it difficult to perform work on the ramp while maintaining traffic. Consideration should be given to temporarily closing ramps and providing detours in such cases.

640-8 Detours

When a detour has been designated for a project ***(see Section 602-6)***, provisions must be made for erecting adequate Detour signing along with other appropriate traffic control devices. The plans shall specify all necessary detour traffic control in accordance with the **OMUTCD** and this Manual (also see related typical applications in ***Sections 607 and 698***). The plans shall provide the appropriate traffic control information, for installation by **ODOT**. On local or other projects where detour traffic control cannot be provided by the maintaining agency, the plans shall provide for installation by the contractor.

Reassurance detour signing in rural areas should be erected at intervals not to exceed 2 miles. In urban areas, detour signing should be spaced no more than two blocks apart.

640-9 Contractor Access

Work zones requiring barrier protection of the work area can, if not properly addressed, create circumstances which either prohibit contractor access to the work area or make such access unnecessarily difficult.

When barriers are used to maintain traffic, designers should address access to the work area, especially when it is perceived that lack thereof could be an unreasonable burden on the contractor.

Where the highway is closed to traffic, barricades and gates shall be provided as shown in **SCD MT-101.60.**

640-10 Private Driveway Access

Except as noted herein, where private drives exist within the work area, access to the drives shall be maintained. It may be necessary to adjust the work procedures to work around the drives as much as possible and to provide temporary access to the drives when normal access cannot be provided.

At urban residential locations, access to residential driveways may be denied for a few hours at a time after adequate advance notice of closure has been provided to the residents of the property involved.

640-11 Temporary Roads

640-11.1 General

A temporary road is any crossover, runaround, ramp, roadway, etc., whose sole purpose is to temporarily maintain traffic during construction. After construction is complete, temporary roads

are typically removed.

Temporary roads are required when the existing roadway is inadequate to properly accommodate both the work and the traffic. They may also be required in certain cases where bridge construction or reconstruction does not facilitate part-width construction or realignment to the extent that the existing facility can serve as the temporary road. The use of runarounds and temporary structures in such cases shall be evaluated by the designer for cost-effectiveness and public service.

640-11.2 Design Speed

The design speed used in designing temporary roads shall be that which is discussed in ***Section 640-18.1.***

640-11.3 Geometrics

The geometric design of temporary roads should be commensurate with the chosen design speed. Pavement design criteria is provided under **CMS 615**. Typical roadway plans for temporary roadway are provided in **L&D Manual Volume Three, Figures 1306-6s and 1306-7s**.

The horizontal alignment of temporary roads shall comply with the criteria discussed in **L&D Manual Volume One, Sections 202.1 and 202.2**. Superelevation of temporary roads is discussed in the following section. Spirals are not required.

Crest and sag vertical curves on temporary roads should comply with **L&D Manual Volume One, Section 203.3** using minimum criteria. Maximum allowable grades are the values shown in **L&D Manual Volume One, Figure 203-1** under hilly terrain for the appropriate design speed.

Stopping sight distances shall meet or exceed the minimum criteria discussed in **L&D Manual Volume One, Section 201.1** and pavement cross slopes shall be as discussed in **L&D Manual Volume One, Section 301.1.5**.

The designer shall also ensure that vertical clearances in conformance with **L&D Manual Volume One, Section 302.1** (existing structures to remain) are provided.

Additional general information regarding geometric design is provided in ***Section 640-2.***

640-11.4 Superelevation

Except as noted in ***Section 640-12.1***, superelevation on temporary roads should conform to the requirements shown in **L&D Manual Volume One, Figure 202-11** for design speeds greater than or equal to 50 miles per hour (80 kilometers per hour) and **L&D Manual Volume One, Figure 202-5** for design speeds less than 50 miles per hour (80 kilometers per hour).

640-11.5 Lane Width

Lane widths of temporary roads should conform to the requirements discussed in ***Section 640-2.***

Where horizontal curve geometrics are less than adequate for the temporary road conditions (D_c>10 degrees), curve widening should be provided as called for in the ***Table 697-4***.

640-11.6 Guardrail Offset and Sideslopes

CMS 615.04, permits a minimum guardrail offset of 1.5 feet (0.5 meter) and a maximum side slope of 1.5:1. These dimensions are appropriate for absolute minimum design, but design above these

values should be provided when feasible. For design speeds over 40 miles per hour (70 kilometers per hour), a minimum shoulder width and guardrail offset of 6 feet (1.8 meters) is desired and 4:1 side slopes are desired where right-of-way is available.

Barrier placement along temporary roads shall conform to the appropriate requirements of **L&D Manual Volume One, Section 600**.

640-11.7 Pavement

CMS 615.05, provides Class A and Class B pavement designs for temporary roads. These designs are intended to be specified on projects with large traffic volumes where the proposed project pavement design is stronger than either of these two designs. A temporary road pavement should not normally be stronger than the permanent pavement design of the project.

For a temporary road pavement design that is weaker than Class A or B, the design should be based on the anticipated total equivalent 18-kip single axle-load applications and determined from information contained in the **Pavement Design Manual** published by the **Office of Materials Management.**

For temporary road pavement that is to be used for a short time (less than two months) by moderate traffic volumes (2000 ADT or less), **CMS Item 410** Traffic Compacted Surface, stabilized with **CMS Item 616**, may be provided.

640-12 Crossover Construction

640-12.1 General

For general information regarding crossover construction, see **OMUTCD Section 6G.15 and *Section 606-16***. Further detail information on traffic control for crossovers is provided in this section and in **OMUTCD Figures 6H-39 and 6H-40**, ***TEM Sections 607-12 and 607-13, Figure 698-4*** and **SCD MT-95.70**.

All temporary crossover areas shall be illuminated as shown on **SCD MT-100.00**, and the transition areas for temporary crossovers shall be delineated in accordance with **SCD MT-99.31**.

All temporary crossovers shall be removed at the completion of the current proposed work unless retention for future use is recommended and justified by the **District**. Any crossover which is to remain for future use or left in place without use between construction seasons shall be camouflaged with an earth overlay so that the crossover area appears as part of the normal median.

640-12.2 Traffic Separation

Adjacent lanes, carrying traffic flowing in opposite directions on Interstates and other freeways, shall be separated by concrete barrier as shown in **SCD MT-95.70**. Concrete barrier separation should also be provided on other high-speed multi-lane divided highways.

The use of breaks in the traffic separation runs, to permit access, should not normally be allowed. For unusual circumstances where breaks are necessary, each end of the barrier shall be protected by a temporary impact attenuator.

640-12.3 Considerations for Reversed Flow

When a traffic diversion requires that two-way operation be maintained on a roadway which normally carries one-directional traffic, as is the case in crossover construction, the designer shall

provide temporary barrier protection from obstacles to accommodate the reversed movement. The designer should evaluate the project for locations requiring barrier and/or bridge terminal assemblies and specify the appropriate protection **(see SCD MT-95.82)**.

640-12.4 Crossover Geometric Design

For guidance on traffic control for crossovers, see ***Section 640-12.1*** and **SCD MT-95.70**. ***Figures 698-6 through 698-9*** provide geometric detail information for two-lane crossovers. For single-lane crossovers, decrease all pavement widths by 12 feet. The 3-degree (600-meter radius) reverse curves are appropriate for rural temporary crossovers. In urban areas the curvatures may be increased to 5 degrees (the radii may be decreased to 350 meters), provided the posted speed is reduced to 45 miles per hour (75 kilometers per hour). Superelevation for these curves shall be limited to 0.016 sloped toward the inside of the curves. Variations in design due to mainline curvature will be considered on a case-by-case basis.

The plans should detail temporary crossovers, including locations, horizontal alignment, typical sections, profiles, and pavement transitions to the existing pavement.

Crossover locations should be very carefully selected with traffic needs being the primary consideration. A tangent section on flat terrain is the most desirable location for constructing a crossover. The designer should field check possible crossover locations to select the optimum site and not necessarily choose the project limits as their location.

640-13 Capacity

640-13.1 General

The following capacity restrictions should be evaluated for each project. The values have been developed to assist in identifying when traffic volumes may cause delays and/or backups during construction phases.

When traffic volumes exceed these values, other steps should be considered in preparing Maintenance of Traffic Plans. These include re-sequencing construction to allow additional lanes to be used, use of shoulders as traffic lanes, providing additional advance Warning Signs, use of alternate routes and corresponding signing, use of Portable Changeable Message signs or detours, and night work.

The above steps should be considered when the following conditions exist:

1. On two-lane highways where the ADT is greater than 6,000 (two-way) or where the peak hour traffic is greater than 600 vph (two-way).

2. On multi-lane non-freeway highways (more than two lanes, divided or undivided) where the directional ADT is greater than 14,000 per lane of traffic being maintained, or where the peak hour traffic is greater than 1,400 vph per lane of traffic being maintained.

3. On Interstate and other freeways, lane closures shall meet the minimum criteria presented in the Permitted Lane Closure Maps/Schedules (PLCM), discussed in ***Sections 601-2 and 630-4***. Development of the PLCMs is based on queue length analysis, in accordance with the criteria set forth in ***Section 640-13.2.*** If there is any question as to the validity of the lane closure schedule provided for a specific location, a queue analysis may be performed for the project site in attempt to override the schedule provided in the PLCM.

640-13.2 Queue Length Predictions for Freeways

Except by waiver approval from the **Maintenance of Traffic Executive Committee (MOTEC)**, queue lengths on freeways shall not exceed the maximum thresholds set forth in **ODOT Policy 516-003(P)** ***(see Section 1311)***. An analysis of traffic patterns within freeway sections shall be performed in order to develop maintenance of traffic strategies which attempt to meet these queuing thresholds. The queuing thresholds set forth in the **Policy** are as follows:

Queue Length	Maximum Duration
< 0.75 miles (< 1.2 kilometers)	Unlimited
0.75 - 1.5 miles (1.2 - 2.4 kilometers)	2 hours
>1.5 miles (> 2.4 kilometers)	Not acceptable

ODOT has adopted the following procedure for predicting queue lengths in construction zones. The calculation is in two parts:

1. The first part requires use of the QUEWZ92 or QUEWZ98 software program to calculate the expected capacity through a given construction zone.

2. The second part requires the application of the calculated capacity to a spreadsheet program developed by **ODOT** for calculating potential queue lengths at a given construction site.

QUEWZ92 or QUEWZ98, which is an acronym for Queue and User Cost Evaluation of Work Zones, was developed by the **Texas Transportation Institute (TTI)** to calculate queue lengths in work zones and the associated costs of delay attributed to the reduction in available lanes. This program shall be used to calculate capacity, an intermediate output. Copies of the program may be purchased from **McTrans Center** ***(see Table 197-3)***.

Input requirements for the program are:

1. Number of directions in which lanes are closed (one or two);

2. Number of existing lanes for each direction;

3. Number of open lanes in work zone for each direction;

4. Length of the closure;

5. Time of the lane closure and work zone activity;

6. Traffic volumes (AADT or directional hourly counts);

7. Cost update factor, based on the Consumer Price Index (in today's dollars expressed as a percent of 1990 dollars):

   Cost Update Factor, December 2000 = 133%; and any future cost update factors can be calculated as: Cost Update Factor = Consumer Price Index / 130.7;

8. Percentage of trucks; and

9. Design speed, work zone speeds (default values provided).

QUEWZ-98 allows for adding the excess emissions estimates to the road user cost output option.

It should be noted that no compensation for grade is called for in this software. However, it

appears from field observation that truck traffic has a greater effect in decreasing capacity on a positive grade than on a negative grade. The designer should consider the potential effect of grade on projects by calling for shorter lane closures in areas of high truck volumes on single-lane uphill grades than would otherwise be specified.

The Intermediate Output provided by this program is expected capacity in vehicles per hour of day

The program's Final Output provides:

1. Length of queue by hour of day. This is not used for **ODOT** queue calculation; **ODOT** spreadsheet used instead.

2. Cost of delay to traveling public as a result of the traffic queue caused by a reduction in the number of traffic lanes. Since this is not relevant to the calculation of queue length, it is used only to determine liquidated damages, see ***Section 640-24***).

The capacity calculation provided by the QUEWZ92 or QUEWZ98 program as an Intermediate Output is used in the spreadsheet program to calculate the expected queue length. This spreadsheet program can be obtained by contacting the **OTE Maintenance of Traffic Section**. This volume is entered as both the free-flow work zone capacity and the queued work zone capacity.

The number of lanes of queued vehicles must also be entered. The designer should take into consideration the need for including the lane being closed in queue development. Observations have found locations in which there was very little volume stored in the lane being closed. At other locations the queue in the closed lane was the same length as the queue in the open lanes. In other cases, the closed lane carried only a fraction of the volume carried by the open lanes. The engineer must determine individually how to account for the volume carried by the closed lane of a specific project.

640-14 Considering Holidays and Special Events

The designer should, in conjunction with the **District Work Zone Traffic Manager**, investigate the use of lane closure restrictions on Interstates and other freeways during holiday and other significant events.

The plan shall require the contractor to have all existing lanes (a number of traffic lanes equal to the existing highway) open to traffic during specifically designated periods. These requirements are in addition to the requirements identified in the Permitted Lane Closure Maps discussed in ***Section 630-4*** and the requirements identified in **ODOT Policy 516-003(P)** ***(Section 1311)***.

Lane closure restriction schedules for urban locations may differ from schedules for rural locations. Where rural location would be expected to carry high traffic volumes during holiday weekends, some urban routes, such as radial freeway segments leading to a central business district, may be found to carry less traffic during holiday weekends. An analysis of traffic patterns shall be made to determine whether or not it is appropriate to restrict lane closures for designated periods including holiday weekends.

The designated "lane closure restriction" periods shall be identified in the plan and may include, but are not limited to:

1. National holidays and holiday weekends:

   New Years,
   Memorial Day,

Fourth of July,
Labor Day,
Thanksgiving, and
Christmas.

2. Weekends with greater than normal travel:

   Easter,
   Mother's Day, and
   Other weekends, or periods, when regional travel is significant.

3. Periods involving local events having attendance greater than 75,000 persons per day or event, or a lesser attendance for events producing mass arrivals or departures, such as football games.

4. Periods when snow accumulation is probable. During these periods daily isolated lane closures may be used during non-peak hours, weather permitting.

A "holiday weekend," for traffic maintenance purposes, begins at noon on the last normal weekday preceding the weekend. Traditionally, the “holiday weekend” has been considered to end at noon on the first normal weekday following the holiday, however the designer should review the traffic patterns at the specific location. Traffic data shows that at many locations, the traffic on the following weekday morning is not significantly different from a typical weekday morning. In such cases it is suggested that the holiday weekend be considered to end at 6:00 AM or earlier to allow the contractor a full day of normal operation. A day between the holiday and Saturday or Sunday is considered part of the weekend.

Section 630-4 contains information regarding Permitted Lane-Closure Maps/Schedules which are intended for use in the scheduling of part-time lane closures.

640-15 Project Length Restrictions

Although **ODOT** has no written policy limiting the length of lane closures, consideration should be given to potential effects on traffic flow, and the potential negative public reaction to closures of extensive length. These factors are of concern primarily where only a single lane remains open in each direction of travel. In rolling to hilly terrain where underpowered vehicles tend to slow traffic flow, the length of one-lane operations should be minimized. In flat terrain, the length of reduced-lane operations is less critical; however, the designer should give consideration to the type of activities to be performed, and what effect these activities might have on traffic movement. Access to accident sites by tow trucks and emergency vehicles on one-lane operations may become especially difficult if concrete barrier is present on both sides of the lane. Sections of open roadway between adjacent lane closures should meet the lengths suggested in ***Section 640-4.***

The public reacts negatively to seeing lane closures in areas of no activity. To avoid such situations on projects of considerable length, it may be desirable to concentrate activity in one section of the project at a time, and to minimize the lengths of lane closures accordingly. On multi-year projects, concentrating work in a portion of the project each construction season may allow an added benefit of opening the entire highway during the inactive winter months.

The designer should not overlook the advantage of scheduling adjacent corridor improvements simultaneously, if this would minimize the time period for inconveniencing motor vehicle traffic. For example, two adjacent projects, requiring only one season each to construct, could be constructed in the same construction season (rather than in consecutive seasons) to minimize the inconvenience to one season rather than two.

640-16 Work on Detour and Alternate Routes

Work along designated detours and alternate routes is strongly discouraged. These routes carry volumes which may be significantly increased over the volumes carried under normal conditions. The potential for traffic queue development would be greater than if the work were performed prior to implementation, or following elimination of, the detour or alternate route.

Work along a designated detour or alternate route can also create a negative public response. Under such conditions the motorist would be directed around one construction project, only to be directed through another one. See ***Section 640-17*** regarding project coordination.

640-17 Coordination With Adjacent Projects

Coordination of signing between adjacent projects is recommended in order to minimize presenting misleading information to the motorist. If proper location of advance signing for one project results in this signing being located within the limits of another construction project, then consideration should be given to treating the two projects as one project for the purpose of signing.

If two projects implementing the speed-reduction and the double-fines policies are located adjacent to each other or are separated by less than 1 mile (1.6 kilometer), the projects should be treated as one project for the purpose of placing Regulatory Signs. (Also, see ***Section 640-18 and Section 600-2.***)

640-18 Speeds in Work Zones

640-18.1 Design Speed

The design speed for maintaining traffic through a construction zone should remain the posted legal speed limit, except as indicated in ***Section 640-18.2***. Where maintaining the legal speed limit is not feasible or practical, the maintenance of traffic design speed may be decreased below the posted speed limit, with the minimum design speed being 25 miles per hour). Reductions in design speed should be accomplished gradually, in increments of 10 miles per hour or less. Sudden changes in design speed and the related geometrics should be avoided. Advisory speed signing should be provided in accordance with the **OMUTCD**. Posted speed reductions are discussed in ***Section 640-18.2***.

Whenever a speed reduction is to be used, the design speed for maintenance of traffic items shall remain at the original posted speed limit on approaches to the work zone and shall be the temporary reduced speed limit within the work zone.

640-18.2 Speed Limit Reductions

A 10 mile per hour reduction in the speed limit shall be implemented in construction projects on freeways and expressways and on rural four or more lane highways. The speed limit for any other type of facility should not be changed.

Speed limit reductions shall only apply to projects lasting thirty consecutive calendar days or more where traffic is to be maintained. Speed limit reduction is not intended for use with bridge rehabilitation/repair work or night-only lane closures, and is generally not suitable for use on projects of less than one-half mile in length.

Whenever a lowered speed limit is to be used within a section that has more than one original posted speed, the lowest temporarily reduced speed required by the above discussion should apply as the speed limit for the entire length of the project. The speed limit reduction shall be accomplished in 10 mile per hour increments.

Exceptions to the above criteria must be submitted to the **Office of Traffic Engineering** for approval.

When a speed reduction during construction is required, it shall be accomplished by a statement preceding the **Director's** signature on the plan title sheet and by plan note. For the **Plan Note**, see ***Section 642*, Plan Note 642-24**. For the statement intended to precede the **Director's** signature, see **L&D Manual Volume Three, Section 1302.12.4**. The **Plan Note** shall be worded to require that the revised Speed Limit signs be erected or uncovered no earlier than four hours prior to the actual start of work, and removed or covered no later than four hours following restoration of all lanes to traffic with no restrictions.

For projects on which the activity is limited to one section of the site for at least thirty days and then is moved to another section of the site upon completion of work in the first portion, the speed limit reduction shall be limited to only the active portion of the site at the given time. Signing for a speed limit reduction, as well as all other advance construction signing, shall be relocated when the concentration of activity is relocated. For projects on which the activity is scheduled for thirty days or more, with day-to-day variation in activity location, possibly performing a sequence of activities, the speed limit reduction, if applied to the project, should apply to the entire length of project for its entire duration. If the activity location moves significantly from day to day, it is possible that the project does not qualify for speed reduction.

For a project which lasts more than one construction season, if all lanes are open to traffic during the winter months and no restrictions exist, the speed limit shall return to the original posted speed, and temporary Speed Limit signs shall be removed or covered no later than four hours following restoration of all lanes to traffic with no restrictions for the winter. Temporary Speed Limit signs may be re-erected or uncovered no earlier than four hours prior to resumption of work.

The first temporary Speed Limit sign shall be placed either 500 feet (150 meters) in advance of the lane reduction taper or at the point where construction begins (dual mounted for divided highways), whichever comes first. See ***Plan Note 642-24*** in ***Part 642*** for information on locating Work Zone Speed Limit Signs. Signing shall be repeated immediately after each entrance ramp within the zone, at every 1 mile (1.6 kilometers) for 55 mile per hour zones, and at every one-half mile (800 meters) for 45 miles per hour zones. The sign may also be repeated in advance of intermediate lane closures. The REDUCED SPEED AHEAD sign (R2-5a) shall be placed in advance of the beginning point of the speed reduction zone; at 1000 feet (300 meters) ahead on freeways and expressways and at 500 feet (150 meters) ahead on other rural four-lane divided highways. The R2-1 Speed Limit sign should be erected at the point where the legal speed is resumed, typically 500 feet (150 meters) beyond the end of work, excluding traffic control devices. On divided highways, Speed Limit signs should be dual-mounted.

Where adjacent projects exist, the speed reduction should be continuous from one project to the adjacent project. The project engineer, or other responsible **ODOT** representative, shall insure that speed reduction signing is limited to the first project in the series and legal speed resumption signing is limited to the last project in the series in the direction of flow of the traffic. This procedure should also be applied to projects which are separated by a non-construction zone of up to 1 miles (1.6 kilometers).

640-19 Law Enforcement Officers (LEOs)

LEOs with patrol cars are effective for slowing traffic speed through work zones. Their use shall be specifically identified in the construction plans.

In general, LEOs should be positioned to direct traffic at the point of lane restriction or road closure and to manually control traffic movements through intersections in work zones. Their primary purpose is to ensure the safe, efficient and orderly movement of traffic. They are not to be used for the

convenience of the contractor at **ODOT** expense.

For lane closures, the use of LEOs should be required during initial set up periods, tear down periods, substantial shifts of a closure point or when new lane closure arrangements are initiated. Use of LEOs is required during the entire advance preparation and closure sequence where complete blockage of traffic is required. LEOs should not be used where the **OMUTCD** intends that flaggers be used.

Use of LEOs by contractors other than the uses specified above will generally not be permitted at project cost. LEOs may be used to circulate through the work area, with flashing lights off, to provide a general slowing of traffic.

For projects specifying the use of LEOs by municipalities, the designer shall contact the cities that are to provide the LEO to ensure that the necessary patrol services will be available. If the municipality cannot guarantee the availability of services, the plans should be modified to use other available LEOs from either the sheriff department or **OSHP** or eliminate the LEO from the plans.

State Highway Patrol Officers may be specified on rural Interstate projects. They shall not be used exclusively on other projects when local LEOs are available.

640-20 Temporary Traffic Control Devices

The design and application of standard traffic control devices for temporary traffic control zones are addressed in **OMUTCD Part 6**, ***Sections 605, 607, 641 and 642***, in the **Traffic SCDs** and in **CMS 614.04.**

640-21 Removal of Logo Signs

As noted in ***Sections 650 and 660***, Logo signs (which include establishments for Gas, Food, Lodging, Camping and Attractions) are the property of **Ohio Logos, Inc.** and are not to be removed or replaced by **ODOT** staff or by contractors working for **ODOT**. The contractor shall notify **Ohio Logos** (toll-free 1-800-860-LOGO) at least sixty days prior to the date of desired removal. If maintenance work necessitates removal of the LOGO sign, **Ohio Logos** must be given reasonable time to remove the sign. Failure by **Ohio Logos** to respond in reasonable time may necessitate removal by **ODOT** staff.

640-22 Temporary Lighting

On contract work, the contractor is responsible for obtaining power for temporary lighting. Power shall not be obtained from an existing nearby highway lighting system.

For additional guidance in use of temporary lighting, see **SCDs MT-100.00, MT-102.10 and MT-102.20**, and **Plan Note 642-29** in ***Section 642***. ***Part 11*** of this Manual provides additional guidance for general lighting design principles.

640-23 Temporary Traffic Barrier

640-23.1 General

The various types of temporary traffic barrier are addressed in ***Section 605-14***. Additional design details are provided in this section.

640-23.2 Length of Need

The method used to design the length and location of barrier for maintenance of traffic applications should be as discussed in **L&D Manual Volume One, Sections 602.1.2 and 602.1.3** for determining barrier length.

Length of need typically does not include attenuators, thus work zone design must take this into account.

640-23.3 Portable Concrete Barrier (PCB)

640-23.3.1 General

The decision to use PCB is based upon characteristics of the work zone and engineering judgment. As noted in ***Section 605-14.4.1***, the use of PCB should be required during construction in any area where penetration or deflection permitted by other traffic control devices cannot be tolerated.

Since the possible number of encroachments into the work zone increase over longer periods of time, PCB should be considered for use where long-term work zones will exist. Also, work zones which will have heavy equipment or dangerous obstacles near the traveled way should be considered for PCB protection. Where the work zone involves drop-off areas, the information in ***Section 640-6*** should be used to determine where to use PCB.

As noted in ***Section 640-12.2***, PCB is required to separate opposing traffic on high-speed highways ($\geq$ 45 miles per hour) which are normally separated by a median.

Glare screen should be considered for use on PCB in accordance with **L&D Manual Volume One, Section 604.1.** See ***Section 605-18*** for additional information about screens.

PCB is also required on bridge decks where the parapet or guardrail is removed. **SCD PCB-91 and the Design Data Sheet PCBDD** (accessed from the Office of Structural Engineering website by using the "Bridge Standards" link) provide additional information for Bridge-Mounted Portable Concrete Barrier.

640-23.3.2 End Treatment

The exposed end of the PCB should be located at a distance from the edge of the traveled way equal to the clear zone distance for the facility as discussed in **L&D Manual Volume One, Section 600.2.** When this is not practical, impact attenuators shall be provided on the exposed ends of PCB located within the clear zone.

Exposed ends of PCB located outside the clear zone shall be tapered. If two PCB runs overlap, with the first PCB protecting the road user from the leading end of the second, that leading end does not need to be tapered.

For acceptable flare rates for PCB, see **L&D Manual Volume One, Figure 602-1** and the **SCDs.**

See ***Section 620-2*** for information on the **NCHRP 350** requirements.

640-23.3.3 Anchoring PCB

Anchoring of PCB may be considered to prevent excessive deflections of the barrier. For example, where a deflection by one vehicle could relocate the PCB into the path of opposing traffic, or on bridge decks where a deflection could cause the PCB to fall from the deck. Anchoring of PCB located on bridges is required as shown in **SCD PCB-91.**

640-23.3.4 PCB Connections

The hinged connection and J-J Hook connection for PCB currently meet **NCHRP Report 350**

Test Level 3 (TL-3) crash test criteria. For additional information, see **SCD RM 4.1M and RM 4.2M**.

640-23.4 Plastic Water-Filled Barrier

A plastic water-filled barrier provides positive separation and redirective capability in work zones; however, it deflects substantially upon impact. For this reason, it cannot be used as an alternate in all situations to PCB. The designer must ensure that there is adequate clearance behind the barrier to accommodate expected deflections.

For portable water-filled barriers, the minimum length of need recommended by the manufacturer should be provided if it is greater than the calculated length of need ***(Section 640-23.2)***. In locations where the water-filled barrier is used primarily as a visual channelizing device, the length of the barrier is determined in a manner similar to that for drums.

Plastic water-filled barriers may have advantages over PCB in the following situations:

1. Intermediate-term work zones.

2. Emergency management situations.

3. Moving operations, particularly on low-speed urban roadways.

4. Locations with limited vertical clearance, due to equipment needed to place.

5. Locations requiring restricted dead loads, i.e., bridge decks

They may also provide a higher level of channelization at certain locations where drums would normally be used, such as at exit ramps.

640-23.5 Triton

The Triton is a specific plastic, water-filled, portable, longitudinal barrier manufactured by **Energy Absorption, Inc.**

Segments are 78 inches (1981 millimeters) long, 32 inches (813 millimeters) high and 21 inches (533 millimeters) wide. The **NCHRP Report 350 Test Level 2 (TL-2)** version can be used in work zones where speeds are 40 miles per hour and lower. The **NCHRP Report 350 Test Level 3 (TL-3)** version is created by adding two pedestal supports under each segment of the TL-2 design. This increases the effective height of the barrier to 39 inches (991 millimeters) and enables it to be used in work zones where speeds are greater than 40 miles per hour.

The minimum length of an installation of the TL-3 design is thirty interconnected units totaling 195 feet (59.5 meters). The length of need shall begin at the 11th segment from the end of the installation. The minimum length of an installation of the TL-2 design is sixteen interconnected units totaling 104 feet (30 meters). The length of need shall begin at the 5th segment from the end of the installation.

The Triton barrier is approved as its own non-redirective end treatment when the last segment on the end contains no water and the retaining pin is left out of the exposed (free) joint. For TL-3 this section also must be turned upside down and supported by a 5 inches (130 millimeters) modified pedestal. During cold weather, the next nine sections of the TL-3 and the next four sections of the TL-2 should have enough anti-freeze in them to prevent the water from freezing. The rest of the barrier can freeze without sacrificing performance.

A clear unobstructed runout area is needed behind the terminal segments for optimal performance.

The Triton barrier should not be used in locations where impacts by trucks heavier than 4400 pounds (2000 kilograms) are a significant concern.

When used solely as a visual channelizing device, the TL-2 design should be specified regardless of the speed and the minimum length of need requirement shall be waived.

When removing liquid from water-filled barriers, water/anti-freeze mixtures shall be disposed of properly. Various types of anti-freeze are available, each with differing degrees of potential environmental harm. Local ordinances regarding environmental issues should be checked.

See **Plan Note 642-32** in ***Section 642-32*** for additional information.

640-24 Liquidated Damages

640-24.1 Requirements/Guidelines

CMS Item 108.07 provides a table of liquidated damages which are designed to be assessed against the contractor for failure to complete his work on schedule. The liquidated damages presented in this table are based on the cost to administer the project and do not take into account road-user costs.

If **ODOT** desires to assess liquidated damages in excess of those shown in **CMS Item 108.07**, **ODOT** must show the revised liquidated damages are reasonable, based upon costs incurred by the public as a result of the contractor's delay in completing the project. Various methodologies are available for analyzing the cost incurred by the public depending on the specific circumstances.

640-24.2 Calculating Costs of Delay (QUEWZ Software)

One methodology, which is frequently used on Interstate and other freeway reconstruction projects where the number of existing traffic lanes is reduced for maintenance of traffic purposes during construction, is to determine the cost of the additional delay to the road user as a result of the reduction in the number of available traffic lanes. As an aid, the computer program known as QUEWZ-92 or QUEWZ-98 ***(see Section 640-13.2)***, can be used to calculate queue lengths in work zones and the associated costs of delay attributed to the reduction in available lanes.

The cost of delay calculated by the QUEWZ program, or some lesser amount, may be used as the cost of liquidated damages.

640-24.3 Other Considerations

Additional methods available to encourage the contractor to complete his work on schedule include Lane Rental, Incentive/Disincentives, and A + B Bidding. Guidelines on use of these concepts is presented in the Compendium of Traffic Control Options in ***Section 630-2*** and ***Tables 697-1a through 697-1f***.

The Lane Rental concept calls for the contractor to be charged for keeping a lane closed longer than called for in the plans.

The incentive/disincentive concept is typically applied to the completion of a phase of a project.

With A + B Bidding, the contractor bids on the cost of the project and on the time required to

complete the project.

640-25 Pedestrian Considerations

Planning and design for maintaining pedestrian traffic should consider both the characteristics of that traffic and the type of construction activities. An analysis of trip origins, destinations and travel paths is useful for providing adequate temporary facilities.

Pedestrian accommodations within work zones should be provided: where sidewalks existed prior to construction; where the work zone is located along a route to a school or park; where there is evidence of pedestrian usage (where well-worn paths exist, for example); or where existing land use generates pedestrian traffic.

In residential and commercial areas, adequate pedestrian access should be provided to properties abutting a work zone.

Use of increased pedestrian crossing times at signalized intersections (based on a walking speed of 3 feet per second (1 meter per second)) may be necessary, particularly in locations where the percentage of elderly pedestrians is expected to be significant. See ***Section 603-2*** for additional information on pedestrian issues that should be considered.

The following general principles should be followed when designing pedestrian facilities:

1. If a sidewalk or bridge that carries pedestrians is closed, provide a temporary walkway (concrete or asphalt) around the work area or direct the pedestrians to an alternate route. Do not force pedestrians to walk through the work area or into traveled lanes.

2. Passageways for pedestrians, especially elderly and disabled, should be well defined and safe for use by these groups. Ramps should be provided for access to streets.

3. All signs or devices should be set up so that they do not cause a hazard for pedestrians. All signs mounted near or over sidewalks should have a minimum 7 foot (2.1 meter) vertical clearance.

4. Minimum width of walkway shall be 5 feet (1.5 meters). Wider walkways are required in areas of high pedestrian activity.

5. Pedestrian walkways shall be free of any obstructions or hazards (holes, debris, mud, etc.). It is especially important to cover or repair any holes and to have broken or damaged sidewalks repaired quickly.

6. Lighting should be provided for temporary walkways if the existing facility was lighted.

7. Fixed walkway and canopy-type pedestrian protection should be provided in the case of long-duration building projects involving construction, demolition and repair activities located close to the street.

8. The design of a temporary pedestrian structure shall be approved by the **Office of Structural Engineering**. The following criteria shall be used:

   a. Live Loading - 85 psf (4.0 kPa)
      Maximum Allowable Live Load Deflection - 1/800 of the span with no allowable increase for temporary structure.

   b. Minimum Width - 5 feet (1.5 meters) face to face of railing.
      Railing - 5 feet (1.5 meters) high with chain link fence fabric.

640-26 Advance Work Zone Information Signs

Advance work zone information signs may be required as part of the maintenance of traffic plan for major construction projects. Their need is usually determined by the Corridor Traffic Management Team during their review of the project. These signs are fixed message types and advise the motorist of alternate routes, possible delays, etc. The signs are generally located at extreme distances from the work area.

To ensure uniformity in the design and application of these signs, the following guidelines will apply:

1. These signs shall be shown in the plans whether supplied by the contractor or by others. This choice shall be clearly indicated in the plans. The normal procedure is for the contractor to provide the signs.

2. The location of the signs shall be field checked by the designer to ensure that there are no conflicts with existing features or with other signs in the area. The designer will assure that signs are not blocked by being too close to other signs and that the motorist has sufficient time to read, understand and act on the information provided by all the signs.

3. The plans shall indicate the legend, level and size of the signs. The signs shall be considered supplemental guide signs as described in the **OMUTCD Section 2E.32 and Tables 2E-2 and 2E-4.**

4. The signs shall be black on orange, including a black border. The layout shall conform to the **OMUTCD and SDM Appendix C**.

5. Where appropriate, advance work zone information signs shall make use of the same exit numbers, route numbers, directions and destinations as shown on the permanent guide signs.

6. In some instances, instead of providing separate installations, it may be desirable to modify existing overhead guide signs. These changes are accomplished by providing black-on-orange overlays to cover portions of the existing signs. Letter size on these overlays should be the same as on the existing signs. When lane arrows are to be covered, rather than using a blank overlay, the legend “LANE CLOSED” shall be used. When a ramp is being closed, rather than using a blank overlay to cover the entire sign, the legend “CLOSED” shall be used on a diagonal overlay (lower left to upper right) on the sign. The size of lettering on overlays and the size of the overlay shall be indicated in the plans. The minimum letter size for “LANE CLOSED” shall be 10" E. The minimum letter size for the diagonal “CLOSED” overlay shall be 12" E.

7. When regulatory information is provided, it shall be displayed separately as a standard black-on-white sign. Mixing of black-on-white regulatory information on a black-on-orange information sign is prohibited.

8. If the motorist is being detoured or if an alternate route is provided, the route should be signed with assemblies consisting of the appropriate black-on-orange (DETOUR or ALT) marker with a standard route marker and arrow plate. If more target value is desired, this trail blazer information may be shown on an orange panel, M2-H3 type. See **OMUTCD Section 2D.32**.

   Route marker assemblies shall be sized according to the type of road on which they are located in accordance with the **OMUTCD**.

9. Supports for sign installations shall conform to all existing standards for permanent signs. These signs should not be attached to existing supports.

10. All advance work zone information sign installations located outside of the project work limits shall

be paid for under appropriate 630 items (signs, supports, concrete, breakaway connection, overlay, removal, etc.) This requirement does not apply to advance warning signs or to sign installations within the work limits.

640-27 Retiming of Existing Traffic Signals

Modifications to the normal traffic flow often create a need to retime existing traffic signals within the work zone and/or around the work zone along detours, alternate routes, or parallel arterial streets. The plans shall include revised signal timing where necessary. The **District** will determine whether it will be the responsibility of the consultant to determine the timing or whether the timing will be provided by the **District** or local agency, to be included in the plans by the consultant.

Where work zones are located on freeways, signal timing revisions may be found necessary in order to accommodate increased volumes at exit ramps where it is expected that there will be a significant increase in volume due to work on the mainline or due to closure of a ramp at an adjacent interchange.

Where signals are located within a work zone, signal retiming may be found necessary to improve capacity on the legs of the intersection where lane reductions are in effect.

In addition to retiming of signals at exit ramps and within work zones, it may also be necessary to retime additional signals as follows:

1. At nearby signals which are coordinated with the signal at the exit ramp or within the work limits.

2. Along routes which are designated as detour or alternate routes.

3. Along parallel arterial streets which are expected to carry additional volumes due to closure of entrance ramps or due to increased exit ramp volumes.

4. Closed loop systems at locations where a series of entrance ramps is closed to reduce mainline volumes.

It may be necessary to retime the signals with each phase of construction. Where traffic is detoured in only one direction per construction phase, signal timing along detours should be timed to allow progression in the direction of the detoured traffic.

641 PLAN PREPARATION / PRODUCTION

641-1 General

The **L&D Manual Volume Three** describes **ODOT** plan preparation and production guidelines and standards. Maintenance of Traffic (MOT) plans are addressed in **Section 1306** of that manual. Additional information specific to MOT plans is provided in this section and ***Section 640***. The detail needed in Maintenance of Traffic plans depends on the complexity of the project. Adjustments in the field may be necessary when unforseen circumstances arise.

The following sections provide information about various components of the Temporary Traffic Control Plan, including detail information about **Traffic SCDs and PISs**.

641-2 Temporary Traffic Control / Maintenance of Traffic (MOT) Plans

641-2.1 General

As noted in ***Section 602-2***, Temporary Traffic Control (or Maintenance of Traffic) Plans are used to describe the temporary traffic control measures that are to be used for facilitating the road users through a work zone. These plans play a vital role in assuring a continuity of safe and efficient traffic flow through the work zone.

641-2.2 Plan Sheets

The traffic control plan may include plan sheets for each sequence of operation, to show all temporary signing and pavement marking applicable to the phase. Additionally, removal or covering of non-applicable signs should be indicated on the plan.

641-2.3 Plan Notes

Standard maintenance of traffic **Plan Notes** are in ***Section 642.*** Additionally, the designer must provide notes to explain any requirements of the contractor which are not covered in the standard notes or elsewhere in the plans or the specifications.

641-2.4 Sequence of Operation Notes

The designer should also provide sequence of operation notes in order to insure that the traffic is maintained as may have been agreed upon by **ODOT** and the public. For additional information regarding development of a sequence of operation, see ***Section 640-3.***

641-2.5 Designer Notes

In addition to the information found throughout this chapter, Designer Notes specifically related to the **Standard Construction Drawings (SCDs)** have been included in this section. Designer notes have also been included with the **Plan Notes** in ***Section 642***.

641-2.6 Quantities

As shown in **CMS 614** and in the **Item Master**, many of the traffic control quantities should be itemized, including signing, pavement marking and concrete barriers. (The **Item Master** and the **Summary of Contracts Awarded** are both available from the **Office of Estimating**.) Non-itemized quantities will be paid for as **Item 614 Maintaining Traffic**.

641-2.7 Plan Reviews

The Maintenance of Traffic plan for all projects on Interstates and Interstate look-alikes with construction cost expected to exceed $10,000,000 shall be submitted to the Multi-Lane Coordinator (MLC) at each stage of development as per **Policy 516-003(P), Section II B1(c)**. This policy is included in ***Section 1311***.

Other MOT plans may be submitted to the **Office of Traffic Engineering (OTE) Maintenance of Traffic Section** for review/advice.

641-2.8 Waiver Approval

Lane closures shall meet the requirements of the permitted lane-closure schedule provided in ***Section 630-4***. Any request for exception to this lane-closure schedule shall be submitted for waiver approval to the MLC. Any waiver request, if not submitted for review and approval during the planning stage, should be submitted as soon as possible during the design stage so that the maintenance of traffic plan can be developed accordingly.

641-3 Traffic Plan Insert Sheets (PISs)

Traffic PISs are addressed in general in ***Section 104***. They are addressed as appropriate throughout the text of this Manual; and this section also provides specific information about the application of most of the traffic-related **Traffic PISs**. **Traffic PISs** are used in a plan as a plan sheet. They can be used as is or modified as needed. They are available in electronic format from the **ODOT** web site from the **Design Reference Resource Center (DRRC)**.

641-4 Standard Construction Drawings (SCDs)

SCDs are addressed in general in ***Section 103***. They are addressed as appropriate throughout the text of this Manual; and this section also provides specific information about the application of most of the traffic-related **SCDs**. A list of applicable **SCDs** is to be included on the title sheet. The **Traffic SCDs** are available in electronic format from the **ODOT** web site from the **Design Reference Resource Center (DRRC)**.

641-5 Closing Right or Left Lane of a Multilane Divided Highway (MT-95.30 and 95.40)

641-5.1 General

MT-95.30 depicts traffic control for closing the right or left lane of a multilane divided highway using drums. **MT-95.40** is used when construction procedure or the condition requires that the work area be protected by portable concrete barrier (PCB) in accordance with **L&D Manual Volume One**.

The designer should check the existing median width to determine if sufficient width exists for erection of the median signs. If not, a smaller size median sign should be specified in **CMS 614 Maintaining Traffic**.

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs), truck-mounted or self-contained impact attenuators. When required, these units must be specifically identified in the plans. When included, these items shall have separate notes and/or details as well as separate pay item.

641-5.2 Advance Warning Sign Groups

SCDs MT-95.30 and 95.40 allow the designer to require extra Advance Warning Sign Groups

(AWSGs) when traffic is expected to back-up beyond the standard advance Warning Signs. Whenever this **SCD** is specified in a plan, the designer should analyze the anticipated traffic demand, peaking characteristics, capacity and expected queue lengths, and include this analysis with the preliminary Maintenance of Traffic submission. If the queue is expected to extend beyond the normal ROAD WORK AHEAD sign (W20-1), extra AWSGs should be specified in the **Item 614 Maintaining Traffic Plan Note** ***(see Sections 642-2 and 642-33)***. The first extra AWSG should be located a distance, in whole miles, in advance of the lane taper which is at least equal to the longest anticipated queue length. Additional AWSGs should be located at 1 to 2 mile (1.6 to 3.2 kilometer) intervals between the first AWSG and the normal Warning Signs location. AWSGs would typically be specified for 2 miles (3.2 kilometers), 3 miles (4.8 kilometers), 5 miles (8 kilometers) and 8 miles (12.8 kilometers) up to the distance needed to deal with the anticipated queue.

If the construction will extend over a holiday period, or any other anticipated period of unusually high traffic demand, a separate queue length analysis should also be made for that period. This condition may require more AWSGs and **Plan Note 642-34** ***(Section 642-34)*** would be used.

The **Plan Note** ***(Section 642-33 or 642-34)*** added within **Item 614 Maintaining Traffic** should specify the distance (in whole miles) on the W16-3a Distance plate which is placed below the RIGHT/LEFT LANE CLOSED AHEAD sign (W20-5, W20-5a). This sign should be located approximately 1 mile (1.6 kilometers) in advance of the calculated end of the queue. The distance shown on the plate should be the distance to the beginning of the lane taper.

641-5.3 Advisory Speed Sign (W13-1)

The designer may also specify the use of the Advisory Speed sign (W13-1) by a **Plan Note** in **Item 614 Maintaining Traffic**. Unless specified, this sign would only be used when directed by the project engineer. The designer may also specify the speed to be shown **(see OMUTCD Section 6F.45)**. A speed reduction, if any, would normally be 10 miles per hour. If the speed is not specified, the speed is as directed by the project engineer. If the regulatory speed limit has been altered by establishment of a lower legal speed limit for the construction activity, the Advisory Speed sign should not be used.

641-5.4 Pavement Markings

The work zone edge line parallel to the roadway (i.e., beyond the taper edge line) is used only when specified by the plans. The use should be specified in the **Item 614 Maintaining Traffic Plan Note** with an estimated quantity carried to the General Summary. See Note 11 on **SCD MT-95.30** (see Note 9 on **SCD MT-95.40**) and **CMS 614.11** for the type of work zone line to specify. Use of this line should be based on engineering judgment and include consideration of the length of the work, time of the closure, sequence of the work, including any need to remove the line in subsequent phases, encroachment on other lanes or the shoulder, the type of work, the geometrics in the area, and the relative cost of paint and work zone tape.

641-5.5 Illumination

In cases of unusual horizontal/vertical curvature, the designer may want to provide illumination of the taper area(s) depending on traffic volumes, accident history or patterns (particularly those involving crossing of the center line).

641-5.6 Bid Items

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**: Signs, Cones, Drums, Flashing Arrow Panel, Warning Lights and Protection Vehicle.

The following items will be shown as a separate quantity in the plans, when required:

Item 614,	Work Zone Edge Line, Class 1 (By Type)	Mile (Kilometers)
Item 622,	Portable Concrete Barrier,___" (____ mm)	Foot (Meter)
Item 614,	Barrier Reflector	Each
Item 614,	Work Zone Impact Attenuator	Each
Item 614,	Object marker, ____-way	Each

641-6 Closing Right or Left Lane of a Mulitlane Undivided Highway (MT-95.31, 95.32 and 95.41)

641-6.1 General

SCD MT-95.31 and 95.32 depict traffic control for closing the right and left lane, respectively, of a multilane undivided highway using drums. **MT-95.41** is used to close the right or left lane on a multilane undivided highway when construction procedure or the condition requires that the work area be protected by portable concrete barrier (PCB) in accordance with **L&D Manual Volume One**.

The designer should evaluate the possibility or extent of encroachment into open traffic lanes. This evaluation should include consideration of the existing geometrics (including lane and shoulder widths), the type of work being performed during the various construction stages and any additional width required for location of drums or cones and for work zone edge line when used. Depending upon the available lane width of the right lane, for the left-lane closing in **SCD MT-95.32**, it may be necessary to shift traffic onto the shoulder using drums or cones and/or work zone edge line. In this case, consideration should be given to removal of the existing right edge line.

For the right- and left-lane closings shown in **SCD MT-95.31 and 95.32**, if the traffic or any of the traffic control devices are expected to encroach on or over the center line, it may be necessary to close the left lane of opposing traffic, in accordance with **MT-95.32**. For short-term daylight closures, it may be possible to narrow the opposing lanes or shift them onto the shoulder using cones for guidance. Engineering judgment is necessary to determine the best solution. This evaluation should include consideration of the geometrics, traffic volumes and speeds, traffic composition and duration of the work.

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs), truck-mounted or self-contained impact attenuators. These units when required must be specifically itemized in the plans. When included, these items shall have separate notes and/or details as well as separate pay item.

641-6.2 Advance Warning Sign Groups

Additional Advance Warning Sign Groups (AWSGs) should not normally be required. If an analysis should indicate the need for this group, see ***Section 641-5.2***. In this case, **SCD MT-95.30** would have to be included in the plan with a reference in the **Item 614 Maintaining Traffic Plan Note** requiring additional AWSGs as shown on **MT-95.30** as part of the signing required for **MT-95.31** with the exception that median-mounted signs would not be used.

641-6.3 Advisory Speed Sign (W13-1)

The designer may specify the use of the Advisory Speed sign (W13-1) by a note in **Item 614 Maintaining Traffic *(Section 642-2)***. Unless specified, this sign would only be used when directed by the project engineer. The designer may also specify the speed shown **(see OMUTCD Section 6F.45)**. A speed reduction, if any, would normally be 10 miles per hour. If the speed is not

specified, the speed would be as directed by the project engineer. If the regulatory speed limit has been altered by establishment of a lower legal speed limit for the construction activity, the Speed Advisory plates should not be used.

641-6.4 Pavement Markings

The work zone edge line parallel to the roadway (i.e., beyond the taper edge line) is used only when specified by the plans. The use should be specified in the **Item 614 Maintaining Traffic Plan Note** ***(Section 642-2)*** with an estimated quantity carried to the General Summary. See Note 5 on **SCD MT-95.31** and **CMS 614.11** for the type of work zone line to specify. Use of this line should be based on engineering judgment and include consideration of the length of the work, time of the closure, sequence of the work, including any need to remove the line in subsequent phases, encroachment on other lanes or the shoulder, the type of work, the geometrics in the area, and the relative cost of paint and work zone tape.

641-6.5 Bid Items

The following items would normally be included with the lump sum bid for **614 Maintaining Traffic**: Signs, Cones, Drums, Flashing Arrow Panel, Warning Lights and Shadow Vehicle.

The following items will be shown as a separate quantity in the plans, when required:

Item 614,	Work Zone Edge Line, Class 1 (By Type)	Miles (Kilometers)
Item 622,	Portable Concrete Barrier,___" (____ mm)	Foot (Meter)
Item 614,	Barrier Reflector	Each
Item 614,	Work Zone Impact Attenuator	Each
Item 614,	Object marker, ____-way	Each

641-7 Closure of a Two-Way Left Turn Lane (MT-95.60)

641-7.1 General

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs), truck-mounted or self-contained impact attenuators. When required, these units shall have separate notes and/or details as well as separate pay items.

The designer should evaluate the possibility or extent of encroachment into open traffic lanes. This evaluation should include consideration of the existing geometrics (including lane and shoulder widths), the type of work being performed during the various construction stages and any additional width required for the location of drums or cones and temporary edge lines when used. Depending upon the available lane width of the right lane, it may be necessary to shift traffic onto the shoulder using drums or cones and/or a temporary edge line. In this case, consideration should be given to removal of the existing right edge line.

641-7.2 Advance Warning Signs Groups

Additional Advance Warning Sign Groups (AWSGs) should not normally be required. If an analysis indicates the need for this group, it would have to be included in the plan with a reference in **Item 614 Maintaining Traffic** that the additional AWSG(s) shall be included as part of the signing required for **SCD MT-95.60** ***(see Section 641-5.2)***.

641-7.3 Advisory Speed Sign (W13-1)

The designer may specify the use of the Advisory Speed sign (W13-1) by a **Plan Note** in **Item 614 Maintaining Traffic**. Unless specified, this sign would only be used when directed by the

project engineer. The designer may also specify the speed to be shown **(see OMUTCD Section 6F.45)**. A speed reduction would normally be 10 miles per hour. If the speed is not specified, the speed would be as directed by the project engineer.

641-7.4 Bid Items

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**: Signs, Cones, Drums, Warning Lights and Shadow Vehicles.

641-8 Closure of Right Lane of Three-Lane Section with Two-Way Left-Turn Lane (MT-95.61)

641-8.1 General

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs), truck-mounted or self-contained impact attenuators. When required, these units shall have separate notes and/or details as well as separate pay items.

The designer should evaluate the possibility or extent of encroachment into open traffic lanes. This evaluation should include consideration of the existing geometrics, including lane and shoulder widths, the type of work being performed during the various construction stages, and any additional width required for the location of drums or cones and work zone edge lines, when used. Depending upon the available lane width of the lane, it may be necessary to shift traffic onto the shoulder using drums or cones and/or work zone edge line. In this case, consideration should be given to removal of the existing right edge line.

641-8.2 Advance Warning Signs Groups

Additional Advance Warning Sign Groups (AWSGs) should not normally be required. If an analysis indicates the need for this group, it would have to be included in the plan with a reference in **614 Maintaining Traffic** that the additional AWSG(s) shall be included as part of the signing required for **SCD MT-95.61** ***(see Section 641-5.2)***.

641-8.3 Advisory Speed Sign (W13-1)

The designer may specify the use of the Advisory Speed sign (W13-1) by a **Plan Note** in **614 Maintaining Traffic**. Unless specified, this sign would only be used when directed by the project engineer. The designer may also specify the speed to be shown **(see OMUTCD Section 6F.45)**. A speed reduction would normally be 10 miles per hour. If the speed is not specified, the speed would be as directed by the project engineer.

641-8.4 Pavement Markings

The work zone edge line parallel to the roadway (i.e., beyond the taper edge line) is used only when specified by the plans. The use should be specified in the **Item 614 Maintaining Traffic Plan Note** with an estimated quality carried to the General Summary. See Note 8 in **SCD MT 95.61** and **CMS 614.11** for the type of work zone line to specify. Use of this line should be based on engineering judgment and include consideration of the length of the work, time of the closure, sequence of the work, including any need to remove the line in subsequent phases, encroachment on other lanes or the shoulder, type of work, geometrics in the area, and the relative cost of paint and work zone tape.

641-8.5 Bid Items

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**: Signs, Cones, Drums, Warning Lights and Shadow Vehicle.

The following item will be shown as a separate quantity in the plans, when required:

Item 614, Work Zone Edge Line, Class I (By Type) Mile (Kilometer)

641-9 Two-Lane, Two-Way Operation (TLTWO) on Four-Lane Divided Highways (MT-95.70, 95.82 and 100.00)

641-9.1 General

The two-lane two-way operation (TLTWO) using continuous PCB, as shown in **SCD MT-95.70**, is a relatively sophisticated method of traffic control which is only suited to certain types of construction activities. TLTWO crossovers should be lighted, either by an existing lighting system or by provision of a temporary lighting system **(MT-100.00)**. **SCD MT-95.82** also provides additional information for this operation. These traffic control and lighting drawings supplement the temporary roadway plans for the crossovers.

TLTWO providing two lanes in each direction may be utilized on six or more lane freeway sections where necessary to provide adequate traffic capacity.

Operations involving two lanes in each direction, or which are forced to include a ramp or other complicating factor should usually result in the use of a **Plan Insert Sheet** specifically modified to show the individual situation.

Normally, the Scope of Services will define the need for TLTWO.

Portable concrete barrier (PCB) details shall be included in the plan by reference to **SCD RM-4.2**.

641-9.2 Crossover Design

The design of crossover roadways is addressed in ***Sections 606-16 and 640-12***. Careful choice of crossover locations is extremely important to the safe and efficient operation of this system. They should be located in tangent, level sections with both roadways on about the same profile elevations. They should avoid bridges, other structures and should be well spaced from interchanges, rest areas or other ramps. Existing signs in the area may have to be relocated, covered or overlayed. All crossover sites should be field checked to the extent that crossovers, tapers and advance signing are approximately located in the field. Crossovers are normally located as a pair to facilitate their use on adjacent construction sections, but they may be separated in order to provide improved operational locations. Consideration should be given at this time to the extent of backups expected and any extra advanced warning which may be necessary due to queues of slow moving traffic.

641-9.3 Advisory Speed Sign (W13-1)

The Advisory Speed signs (W13-1) shown in **SCD MT-95.70** and discussed in Note 3 on that drawing, will not normally be used on a project. Current practices make a strong effort to assure that the design (i.e., speed of the crossover) is comparable to the statutory or revised legal speed of the highway.

641-9.4 Pavement Markings

Notes in the drawing address the need to maintain appropriate pavement markings and eliminate conflicting ones. See ***Sections 605-11.10 and 605-11.11*** and **CMS Item 614.10** for additional information on work zone pavement markings. Also, see ***Section 605-11.12*** and **SCD MT-101.20** for information about work zone raised pavement markers.

641-9.5 Illumination

The designer should review the probable location of crossover lighting units in the field to assure reasonable placement with respect to ditches or other features. When temporary crossover lighting is to be provided, **Plan Note 642-35** ***(Section 642-35)*** is recommended.

SCD MT-100.00 provides for non-breakaway poles located a minimum of 30 feet (9 meters) (preferably 40 feet (12.2 meters)) from the edge of pavement. This is acceptable only if fill slopes do not exceed 8:1, which they do not on most Interstate and other divided highways. If side slopes of greater than 8:1 are encountered without existing guardrail, see **L&D Manual Volume One** for increased setback.

641-9.6 Provisions for Reverse Flow and Use of the Shoulder

The reverse traffic flow will be exposed to obstacles which do not affect the normal traffic flow direction **(see SCD MT-95.82)**. Downstream bridge parapet ends, guardrail ends, etc. must be treated. Normally, additional lengths of temporary guardrail, turn-down anchors and appropriate guardrail to bridge parapet connections will be needed and should be provided separately in the plans. Normally temporary guardrail of this type will be removed to minimize future guardrail maintenance costs. Keep in mind that some existing guardrail-to-bridge parapet connections which are suitable for normal traffic flow direction are unsafe when traffic flow is reversed. Lap joints on existing guardrail need to be reset to correspond with the flow of traffic. Also, the new approach end of the guardrail needs to be refit with an approved end treatment. Turn-down end treatments are not allowed in the clear zone. When replacing the guardrail ends, the run of guardrail will also need to be replaced.

Where traffic flow is reversed, additional Type 3 Object Markers (OM-3) and barrier reflectors should be provided to guide this traffic. The Type 3 Object Marker, also known as Bridge End Markers, are addressed in **OMUTCD Section 3C.01**; and barrier reflectors are addressed in more detail in ***Sections 307 and 605-19*** and **CMS 626 and 720.04**.

The designer shall field review the section of road since traffic will be flowing in the opposite direction from normal, and if a paved shoulder will be used as a traffic lane, the review should determine:

1. If any bridge parapets, safety curbs, etc. restrict the width available for the lane throughout the remainder. If this construction would bring the available lane width to less than 10 feet (3 meters), the shoulder should not normally be used. Even if 10-foot (3-meter) or more lanes are still provided, the obstruction should be well delineated. Bridge End Markers (OM-3) and barrier reflectors on guardrail or parapets will usually be desirable and may be reduced to 25 foot (7.6 meter) spacing when very close to the traffic lane. When old style safety curbs are encountered, they should be painted (reflectorized curb markings) on the approach ends and trailing ends, and barrier reflectors should be applied to the top of the curb to delineate it.

2. If existing signs need to be moved. Existing signs within 12 feet (3.6 meters) of the temporary lane should be reviewed.

    a. Signs behind guardrail: Those at least 4 feet (1.2 meters) behind face of guardrail will not be a problem, and probably as little as 2 feet (0.6 meter) behind rail will be acceptable. Signs closer than 1 or 2 feet (0.3 or 0.6 meter) to face of rail <u>and</u> less than 6 feet (1.8 meter) from the temporary lane are likely to be damaged and, if possible, should be moved further from the road.

    b. Signs not behind guardrail: Major signs on breakaway supports (not behind guardrail) are usually located 30 feet (9 meters) or more from the edge of the through lane and will not

normally be a problem. Any major sign which is closer than 12 feet (3.6 meters) to a temporary lane should be considered for moving back to 30 feet (9 meters) or more from the permanent lane if conditions permit. Since moving signs back enhances overall safety, this work should not be considered incidental to maintaining traffic but should be defined with normal permanent sign plan requirements (elevation views, bid items, removal of sign, removal of support, (new) sign support, signs, breakaway connections, etc.).

c. Major signs in the median: Major signs on breakaway supports located in the median will not function properly if struck by counter-flow traffic. When these signs are within 30 feet (9 meters) of traffic lanes and not otherwise shielded from counter-flow traffic the following steps should be considered:

   i. In many cases, the legend may not be considered essential during construction (County or City Limit signs, etc.) and the sign can be removed, safely stored and later reerected.

   ii. Some breakaways can be modified by replacing the hinge plates with additional fuse plates (fuse plates on both sides of beam).

d. Minor signs (on drive posts) are normally located 6 feet (1.8 meters) from edge of shoulder and this is considered adequate. Any found to be less than 6 feet (1.8 meters) from the paved shoulder should be considered for relocation.

   In some cases, signs can be relocated longitudinally to put them behind guardrail provided for other purposes.

3. If the shoulders are adequate. Shoulders which will be used for traffic flow should be checked to determine if they will support the anticipated loads without becoming too rough to be serviceable. Overlays, and possibly full-depth shoulder replacement, may be needed.

When two lanes will be provided in one direction by using the shoulder, the line separating them will be coincidental with the permanent edge line. Rather than require a contractor to remove parts of an existing white edge line to convert it to a standard dashed lane line, it is permissible to allow it to remain as a solid white lane line **(OMUTCD Section 3B.04)**.

641-9.7 Bid Items

It is intended that separate bid items be included for the following items:

Item 614,	Object Marker, ____-way	Each
Item 614,	Work Zone Pavement Markings (by type)	Foot (Meter)
Item 614,	Work Zone Raised Pavement Marker	Each
Item 614,	Temporary Impact Attenuator	Each
Item 622,	Portable Concrete Barrier, ____" (____ mm)	Foot (Meter)
Item 622,	Portable Concrete Barrier, with Glare Shield or 50" (1270 mm) high	Foot (Meter)
Item 614,	Work Zone Crossover Lighting System	Each
Item 614,	Barrier Reflectors (by type)	Each
Item 630,	Signs (Permanent)	
Item 630,	Supports (Permanent)	

The lump sum for **Item 614 Maintaining Traffic** will cover all other work needed to place, maintain and remove the TLTWO including the following items:

Temporary Signs and Supports
Drums and other channelizing devices
Flashers and lights on signs
Flashing arrow panels
Removal and replacement of raised pavement marker reflectors
Removal of conflicting existing or work zone pavement markings (this is specifically incidental to **Item 614 Work Zone Pavement Markings**).
Temporary Guardrail, Type 5
Temporary Bridge Terminal Assemblies

641-10 Signalized Closing, One-Lane of a Two-Lane Highway (MT-96.10 and 96.11)

641-10.1 General

This standard is to be used where it is necessary to close one lane of a two-lane highway and where the longer length of time of the closure would not lend itself to the use of a flagger. The hazard protected should be commensurate with the protection provided. **SCD MT-96.10** uses drums to close the lane, and **SCD MT-96.11** uses portable concrete barrier (PCB). A typical application for **MT-96.11** would be a bridge deck overlay project. Typical applications for **MT-96.11** would be part width bridge construction, bridge deck edge or parapet replacement or a condition determined by the designer to be so hazardous to the workers or road users that the PCB protection would be required.

The end of a concrete barrier, if not treated properly, can represent the most hazardous part of the installation. Therefore, when **MT-96.11** is used, wherever practical, the exposed end of the PCB should be terminated outside the clear zone. When the design speed is greater than 40 miles per hour and the barrier is located within the clear zone, consideration should be given to terminating the barrier with a work zone impact attenuator.

In the majority of the cases, it will be necessary to construct temporary pavement or rebuild the shoulders to maintain a minimum desirable lane width. This lane width should be the width of the approach lane, but in no case less than 10 feet (3 meters). Wherever possible the lane width shall be in addition to a 1 foot (0.3 meter) offset (preferably 2 feet (0.6 meter)) from any guardrail or concrete barrier. A separate sheet will be required in the plan to show the details necessary to construct the temporary pavement, as well as the actual width of the pavement to be closed.

These signalized closing treatments provide high visibility of one side of the single lane (drums, WZRPMs in **MT-96.10** and PCB, reflective panels, WZRPMs, barrier reflectors and object markers in **MT-96.11**). However, similar night visibility is not assured for the roadside away from the work (only WZRPMs). If a hazard beyond the shoulder, or a constriction such as a bridge parapet or guardrail, exists on that side, additional devices (reflective panels, barrier reflectors, etc.) should be specified on that side also to provide a more balanced outline of the maintained lane.

If adequate room is not available to set up the zone because of driveways or intersections, revision will be required as a separate Maintenance of Traffic Plan Sheet, with the provisions of the **SCD** being adhered to wherever possible.

Where pedestrians are likely to try to pass through the construction area, reasonable provision shall be made for them. If pedestrian traffic is significant, a designated path may be necessary. See ***Sections 603-2*** for further information on accommodating pedestrians.

641-10.2 Duration of Work / Portable Traffic Signals

As noted in ***Section 605-13.2***, temporary traffic signals which will be in continuous operation for fourteen days or less shall be designed, operated and installed in accordance with **SCDs MT-**

96.10, 96.11, 96.21, 96.25 and 96.26 with the following exceptions and qualifications:

1. Luminaires for area illumination are not required.

2. Temporary pavement markings and temporary raised pavement markers are not required for signalized operations lasting less than thirty-six hours.

3. When signalized operation will last less than thirty-six hours, removal of existing conflicting pavement markings is not required if drums (or cones during daylight hours only) provide continuous positive guidance for vehicles.

4. Signal systems of this type shall not be used for situations where traffic, including contractors vehicles, will be entering the traffic stream, from the work site, between signals.

The traffic signal system may either be constructed of standard signal components conforming to **SCDs MT-96.10, 96.11, 96.21, 96.25 and 96.26**, or it may be a portable traffic signal (PTS) which is essentially self contained and mounted on trailers ***(see Section 605-13.2)***.

641-10.3 Capacity and Flow Rates

The maximum length of one-lane operation for one-way traffic signal control is determined by the capacity required to handle the peak-hour demand. ***Table 697-2*** summarizes these conditions.

The hourly rate of flow figures shown in ***Table 697-2*** may not be readily available during the initial analysis of signal timing. In those cases ADT data, as is readily available from reports published by the **Office of Technical Services**, may be used to develop hourly rates of flow. Two factors should be used in this conversion: the peak hour factor (PHF) and "K."

The peak hour factor (PHF) relates the average peak hourly flow to the peak 15-minute flow during the peak hour. If other information is not available, PHF= .90 may be assumed.

"K" relates the peak hour volume to the average daily traffic. If other information is not available, K=0.10 may be assumed.

Using these factors, an approximate hourly rate flow can be determined:

Approximate Hourly Rate of Flow = ADT x K/PHF

EXAMPLE: 9000 (ADT) x 0.1(k)/0.9 (PHF) = 1000 vehicles per hour

This flow rate can then be used in ***Table 697-2*** by finding the approximate hourly rate of flow in the proper column which defines the length of the one-lane operation (from Stop Line to Stop Line). Moving to the left in the table, the total signal cycle length is determined. If the cycle length is considered acceptable, it can be used to help determine the individual signal interval times.

A more accurate method of determining hourly rates of flow is necessary when the closure length is long or traffic volumes are high. When the estimated traffic ADT and closure length exceeds that shown in ***Table 697-8***, collection of more detailed traffic data and more refined analysis of signal timing is recommended.

In these cases, actual current traffic counts should be obtained and analyzed to identify various peak periods for weekdays and weekends, noting particularly any directional imbalances occurring during the peaks. Where traffic patterns are determined to be repetitious and there is significant disparity between peak and off-peak traffic, or there are major differences between various peak periods, then a signal controller capable of adjusting timing to suit the anticipated

traffic flows should be selected.

This can be accomplished in either of two ways:

1. Use of a multi-plan, time-of-day (TOD) controller and time clock to provide preselected timing patterns to suit the various peaks and off-peak times. As compared to the following alternate, this system is less expensive in terms of hardware and installation, but it requires more accurate (and expensive) traffic data collection and analysis to choose appropriate timing patterns and their hours of operation. One, or perhaps two weeks of hourly, directional counts may be needed to develop reasonably reliable timing plans. Once implemented, this system will usually be relatively maintenance free, but if traffic patterns change during construction, additional data collection and retiming may be necessary. The **District** should be prepared to monitor the system operation and provide data collection and timing changes when warranted.

2. A traffic-actuated controller with detectors in advance of each end of the work zone will also compensate for changing traffic patterns. Fully traffic-actuated operation is normally employed once carefully selected controller timing is implemented. The units should adapt to most changes in traffic volume and provide good operation. When compared to the first alternate above, the hardware and installation costs for detection will increase initial installation costs. Also, detectors can be expected to fail or require readjustment during construction, thus increasing maintenance costs. On the other hand, unexpected changes in peak-period demand or timing will usually be accommodated automatically, thus negating the need for signal retiming. The **District** should still be prepared to monitor the signal operation for failure or inappropriate timing.

Where analysis of the traffic data shows that peak periods are not predictable in terms of magnitude, predominant direction of flow or time of occurrence, actuated operation will be the most appropriate choice.

Any existing traffic signals within one-half mile (0.8 kilometers) must be taken into account when determining the effect of signal operation. Coordination, or modification of the existing signal, may be appropriate in cases where queues from one signal may interfere with the operation of the other.

Analysis of signal timing and traffic capacity should assure that the anticipated traffic can be accommodated, or signalized operation of this sort should not be included in the project.

Plan Notes 642-36 and 642-37 ***(Sections 642-36 and 642-37)*** should be included in the plans to obtain multi-plan, time-of-day or an actuated controller when appropriate.

641-10.4 Traffic Signal Details

SCD MT-96.21 and either **MT-96.25 or 96.26** will be required when either **MT-96.10 or 96.11** is used.

Under light traffic the signal will normally operate in a pretimed mode using a simple pretimed controller as described in the upper portion of **Detail B of SCD MT-96.21**, or using an actuated control in a pretimed mode (no detectors, recalls on). However, under certain conditions it may be desirable/necessary to use actuated control with detection or to require a multi-plan pretimed control **(see SCD MT-96.26)**.

The plan shall show necessary signal timing ***(see Tables 697-3 and 697-5)***.

641-10.5 Pavement Markings

Work Zone pavement markings and work zone raised pavement markers (WZRPMs) are required in all cases as follows:

1. Work Zone Stop Lines, Class I: at each end of the work.

2. Work Zone Center Lines, Class I: double solid for 150 feet (46 meters) from each Stop Line.

3. WZRPMs: used as a two-way edge line through the work area on both sides as shown. A painted line is not sufficient due to the differing edge line color required.

The requirements for work zone pavement markings are contained in **CMS 614.11** and the requirements and layout of WZRPMs are contained in **SCD MT-101.20**.

641-10.6 Driveways and Side Roads

Driveways and side roads intersecting within or close to the one-lane portion of the temporary traffic control zone should be considered and treated uniformly. The following alternatives should be considered, with the earlier being considered more desirable than those later on the list:

1. If the drive or street is very close to one end of the one-lane, two-way segment, determine if the signals and Stop Line can be relocated sufficiently to place the intersection outside of the one-lane area.

2. Where drives or streets have low to moderate traffic volumes, consider erecting signs (a STOP sign plus a No Left/Right Turn sign) to allow traffic to only turn away from the central area of the work zone. This treatment is only feasible if cross-corner sight distance in both directions is good and if the near-end of the one-lane segment can be easily seen.

3. Where a residential drive or minor commercial drive is involved and if the work length is very short (perhaps less than 200 feet (60 meters)) and a driver stopped on the drive has good visibility to both ends of the work and both approaches, it may be reasonable to impose only stop control on the drive traffic.

4. Where a public road or alley is involved, consider closing that approach to the intersection, or possibly making it one way away from the work area. This will require discussion with the local agency in charge of the side road. Provisions shall be made for additional ROAD CLOSED signs, Detour signs, ONE WAY signs, DO NOT ENTER signs and other Regulatory Signs.

5. If a driveway serves a business, group or property which also has another usable drive, close the drive in question, after informing owners and tenants of the intended action. Minor widening or improvement of the alternate drive may be considered to provide similar access and to avoid major complaints or litigation.

6. Provide a temporary driveway or minor relocation of the side street to move the entering traffic away from the one-lane segment.

7. If less intrusive methods are not feasible, consider providing another actuated signal phase, complete with at least two signal heads, for the side street or drive. Prior to approval of this method, the designer must obtain projected hourly traffic data for a typical weekday (and weekend if traffic is critical) in order to perform capacity analysis for critical periods. Capacity analysis resulting in poor levels or service will normally preclude use of this treatment.

8. Provision of flagger or police control.

641-10.7 Field Reviews

A field review, by the designer, is required to verify the proposed locations of PCB, drums, pavement markings, signal heads, signs and other features for each phase of the project. Each element shall be tentatively located according to the requirements of the **SCD** and plans to assure adequate visibility and to assure that the controls will be effective. Signal heads shall be visible no less than 215 feet (66 meters) in advance for 25 mile per hour approaches, 325 feet (99 meters) for 35 mile per hour; 460 feet (140 meters) for 45 mile per hour and 625 feet (190 meters) for 55 mile per hour approaches. Signs shall be visible at least 250 feet (76 meters) in advance. Reviews should consider the effects of summer foliage. Any existing traffic controls or other physical features which will detract from safe and efficient operation should be dealt with in the plans. The field check shall also verify that there will be adequate room to perform construction behind barriers or channelizing devices, and that available pavement widths will be sufficient to maintain traffic. The need for temporary pavement or pavement strengthening to carry maintained traffic shall be considered. Changes deemed necessary as a result of this field check shall be incorporated into the Maintenance of Traffic plans by providing details or descriptive notes in the plans. These may include revised locations for signs, signals, pavement markings, PCB or other devices. They may also include requirements to use overhead-mounted signals or additional signals or other control devices and could include requirements to remove foliage on the right-of-way. When overhead-mounted signals are necessary, **Plan Note 642-37** ***(Section 642-37)*** should be included in the plans:

641-10.8 Bid Items

In an effort to obtain consistency in the bidding procedure the following pay items should be used, as required:

Item 615,	Pavement for Maintaining Traffic, Class _____	Sq. Yd. (Sq. Meter)
Item 614,	Work Zone Raised Pavement Marker	Each
Item 614,	Work Zone Edge Line, Class I	Mile (Kilometer)
Item 614,	Work Zone Center Line, Class I	Mile (Kilometer)
Item 614,	Work Zone Stop Line, Class I	Foot (Meter)
Item 622,	Portable Concrete Barrier, ____" (____ mm)	Foot (Meter)
Item 614,	Barrier Reflector	Each
Item 614,	Object Marker, ____-way	Each

All other items will be included in **Item 614 Maintaining Traffic**.

641-11 <u>Flagger Closing One Lane of a Two-Lane Highway (MT-97.10, 97.11 and 97.12)</u>

SCDs MT-97.10 depicts a typical application using a flagger to close one lane of a two-lane highway for a stationary operation. The distance provided from the Flagger Ahead sign (W20-7/W20-7a) to the flagger assumes light to moderate traffic with no substantial back-up, thus the distance allows for a typical back-up of cars plus adequate distance to slow from the approach speed to a stop at the end of the queue. Other locations with heavier traffic or a longer work area will increase the queue length build-up just before traffic is released. The designer should increase this distance ("B") by **Plan Note** when calculations show the need. Further, Note 1 in **MT-97.10**, allows the project engineer to increase distance "B" based on expected or actual field conditions at any time.

SCDs MT-97.11 and 97.12 were developed specifically for use during a paving operation on a two-lane road. Therefore, one shall be included with each two-lane resurfacing plan.

The purpose of these two drawings is to provide guidance for traffic going through a paving operation by the use of flaggers and traffic cones. They provide for the use of cones which are placed laterally across the lane being paved at roads intersecting the closure. They attempt to keep the work area length to a minimum and keep the advance signing and the flagger grouped together.

SCD MT-97.11 should be used with all non-federal two-lane resurfacing projects. **MT-97.12** shall be used with all federal two-lane resurfacing projects.

All items shown on these drawings will be included in the lump sum bid for **Item 614 Maintaining Traffic**.

641-12 Lane Closure in Deceleration Lane (MT-98.12)

Advisory Exit or Ramp Speed signs may exist at interchanges along the deceleration lanes or across from the exit gore. The designer should check the speed of any proposed advisory Exit or Ramp Speed signs to avoid contradictory speed postings with existing signs. Where conflicts exist, the existing signs should be covered or removed. The proposed signs, when compared to the existing signs, should always provide a lower or equal advisory speed.

The opening leading from the freeway/expressway to the ramp shall have a minimum length of 200 feet (61 meters) as shown in Note 4 of **SCD MT-98.12** (this is the distance within which the exiting vehicle must shift laterally to the right to enter the exit ramp). Based on the **1985 Highway Capacity Manual**, maximum capacity, regardless of design speed, occurs at a speed of 30 to 35 miles per hour. Below this speed, the freeway/expressway will experience unstable flow and capacity will decrease. Therefore, to avoid premature unstable flow and keep the facility at maximum capacity, all design elements on the freeway/expressway must meet or exceed an operating speed of 30 to 35 miles per hour.

SCD MT-98.12 shows an opening of 320 feet (98 meters) each, which is associated with a 55 miles per hour exiting speed. Openings longer than 320 feet (98 meters) should be used whenever conditions permit. When conditions will not allow a 320 feet (98 meters) opening, shorter values (but not less than 200 feet (61 meters)) may be used. When shorter openings (associated with a speed at least 10 miles per hour less than the posted speed) are used, Advisory Speed signs (W13-1) shall be provided. See **OMUTCD Section 6C.08** and ***Section 602-5*** for a discussion of taper rates.

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**: Signs, Cones, Drums and Warning Lights.

The following items will be shown as separate quantities in the plans, when required:

Item 614,	Work Zone Edge Line, Class I (By Type)	Mile (Kilometer)

641-13 Lane Closure Before Exit Gore (MT-98.13 and 98.14)

SCD MT-95.30, which pertains to closing the lane in advance of the exit gore, shall be used as a companion drawing whenever **SCD MT-98.13 or 98.14** is used.

The designer should exercise care when using **SCD MT-95.30** in the area of an interchange immediately upstream of the work site. The placement of signs shown in **MT 95.30** for closing the right lane may overlap an upstream ramp and confuse road users as to whether the ramp is open or closed. When this condition prevails, the designer shall provide positive guidance for the exiting road user. This may include showing the exact placement of all signs and tapers noted in **MT-95.30** within both interchanges on a separate drawing, rather than relying on the **SCD**.

The designer shall also use **SCD MT 98.13** when the optional project work shown on the ramp and

beyond the exit gore on the freeway/ expressway does not exist.

Advisory Exit or Ramp Speed signs may exist at interchanges along the deceleration lanes or across from the exit gore. The designer should check the speed of any proposed advisory exit or ramp speed signs to avoid contradictory speed postings with existing signs. Where conflicts exist, the existing signs should be covered or removed. The proposed signs, when compared to the existing signs, should always provide a lower or equal advisory speed.

The opening leading from the freeway/expressway to the ramp shall have a minimum length of 200 feet (61 meters) as shown in **SCD MT-98.13 (Note 2)** and **MT-98.14 (Note 6)** (this is the distance within which the exiting vehicle must shift laterally to the right to enter the exit ramp). Based on the **1985 Highway Capacity Manual**, maximum capacity, regardless of design speed, occurs at a speed of 30 to 35 miles per hour. Below this speed, the freeway/expressway will experience unstable flow and capacity will decrease. Therefore, to avoid premature unstable flow and keep the facility at maximum capacity, all design elements on the freeway/expressway must meet or exceed an operating speed of 30 to 35 miles per hour.

The **SCD MT-98.13** shows an opening and a taper of 320 feet (98 meters) each, which is associated with a 55 miles per hour exiting speed. Openings and tapers longer than 320 feet (98 meters) should be used whenever conditions permit. When conditions will not allow both a 320 feet (98 meters) opening and taper, shorter values (but not less than 200 feet (61 meters)) may be used. When shorter openings and tapers (associated with a speed at least 10 miles per hour less than the posted speed) are used, Advisory Speed signs (W13-1) shall be provided. See **OMUTCD Section 6F.08** and ***Section 602-5*** for a discussion of taper rates.

If the paved shoulder must be used to achieve minimum lane width on the ramp, as noted in **SCD MT-98.13 (Note 6)** and **MT-98.14 (Note 5)**, it may be necessary to reconstruct or strengthen the shoulder to accommodate the additional load. A separate sheet would be required in the plan detailing this shoulder work.

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**: Signs, Cones, Drums and Warning Lights.

The following items will be shown as separate quantities in the plans, when required:

Item 614,	Work Zone Edge Line, Class I (By Type)	Mile (Kilometer)
Item 614,	Work Zone Channelizing Line, Class I (By Type) (Required for closure greater than one day.)	Foot (Meter)

641-14 <u>Lane Closure at Entrance Ramp (MT-98.15 and 98.16)</u>

SCD MT-98.15 (Plan A) generally addresses a lane closure for a situation where the work is in the through lane adjacent to the entrance ramp. **SCD MT-98.16** (Plan B) generally involves a lane closure on the mainline for work in the entrance ramp/acceleration lane area. **SCD MT-95.30**, which pertains to closing the lane in advance of the entrance, shall be used as a companion drawing whenever **MT-98.15 or 98.16** is used.

The designer should exercise care when using **SCD MT-95.30** in the area of an entrance ramp. The placement of signs for closing the right lane contained in **MT-95.30** may overlap an upstream ramp and confuse road users as to whether the ramp is open or closed. When this condition prevails, the designer shall provide positive guidance for the road user. This may involve showing the exact placement of all signs and tapers noted in **MT-95.30** within both interchanges on a separate drawing, rather than relying on the **SCD**.

If the paved shoulder must be used to achieve minimum lane width **(SCD MT-98.15, Note 1and 98.16,**

Note 2), it may require that the shoulder to be reconstructed or strengthened to accommodate the additional load. A separate sheet would be required in the plan detailing the shoulder work.

In order to work on an entire on-ramp, it will be necessary to use both **SCD MT-98.15 and 98.16**. Traffic operation under **MT-98.16** is significantly restricted, and poorer operation is anticipated. Therefore, the design and project implementation should attempt to do as much of the work as possible under **MT-98.15**. This should minimize the time and traffic restrictions involved when **MT-98.16** is used.

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic:** Signs, Cones, Drums and Warning Lights.

The following item will be shown as a separate quantity in the plans, when required:

Item 614,	Work Zone Edge Line, Class I (By Type)	Mile (Kilometer)
Item 614,	Work Zone Gore Marking, Class II (By Type)	Foot (Meter)

641-15 <u>Typical Lane Closures for Ramps (MT-99.17, 99.18 and 99.19)</u>

SCD MT-98.17 shall only apply when work along an exit ramp leaves at least one lane open to ramp traffic and the work is in the inside portion of the ramp curve.

SCD MT-98.18 shall only apply when work along an exit ramp leaves at least one lane open to ramp traffic and the work is in the outside portion of the ramp curve.

SCD MT-98.19 shall be used when work requires that the exit ramp be closed. If one lane on the exit ramp is open to traffic, either **MT-98.17 or 98.18** shall be used.

Advisory Exit or Ramp Speed signs may exist at interchanges along the deceleration lanes or across from the exit gore. When the ramp will remain open, the designer should check the speed of any proposed advisory exit or ramp speed signs to avoid contradictory speed posting with existing signs. Where conflicts exist, the existing signs should be covered or removed. The proposed signs, when compared to the existing signs, should always provide a lower or equal advisory speed.

When **SCD MT-98.19** is included in plans, treatment of the permanent Guide Signs in accordance with the guidelines for Advance Work Zone Information Signs shall be considered. The need for a detour and related signing must also be addressed.

Advance Warning Signs should be placed in such locations that provide adequate sight distance for the existing vertical and horizontal roadway alignment. Use **OMUTCD Table 6C-1** to determine dimensions A, B and C.

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**; Signs, Cones, Drums and Warning Lights.

For an exit ramp closure **(MT-98.19)**, the following item will be shown as a separate quantity in the plans, when required:

Item 614,	Work Zone Edge Line, Class I, (By Type)	Mile (Kilometer)

641-16 <u>Traffic Control for Long Line Pavement Marking Operations (MT-99.20)</u>

SCD MT-99.20 is applicable to all projects with long line markings (center, edge or lane line), except in the following situations:

1. Where the markings will be applied while the area is closed to traffic for other reasons;

2. Where the work area is so short (+/- one-half mile (0.8 kilometer)) that the required sequence of vehicles cannot be assembled while the marking vehicle travels the length of project; or

3. Where the plans require another form of protection.

Also see **CMS 614.11** for additional traffic control requirements for long line pavement marking operations.

If the work will require a lane closure as designated in the table on **SCD MT-99.20**, the plans should include the appropriate lane closure details.

The 18-inch (457-millimeters) cones are permissible only to protect a wet painted line. The larger, 28-inch (711-millimeters) cones shall be provided if they will be used to close off a lane (in daylight), either in the closure transition or through the work area.

641-17 Freeway/Expressway Ends Closures (MT-99.50 and 99.51)

SCDs MT-99.50 and 99.51 are designed to be used where a section of freeway/expressway will terminate at an unopened or unconstructed portion requiring traffic to leave the facility at the last exit.

MT-99.50 should be used when the duration of the closure is six months or less, and when traffic volumes are less than 1300 vehicles/hour/lane for eight hours of the day.

MT-99.51 should be used when the duration of the closure exceeds six months, or when traffic volumes exceed 1300 vehicles/hour/lane for eight hours of the day.

These closures will normally be left in place when the contractor has completed his work and the responsibility to check and maintain them will usually revert to the maintaining agency. The plans should clearly indicate if the terminal treatment will remain in place at the completion of the contractor's work and become the property of the maintaining agency, or if the contractor will be required to remove the terminal.

Typically, the major Guide Signs for the exit will be located in approximately the same location as the W9-H6-144, W9-H5-144 and W9-H4-144 signs as noted on the drawings. It is preferred that the major Guide Signs be overlaid with these messages, if possible. Where overhead Guide Signs exist, it is not necessary to have dual-mounted signs on each side of the directional roadway as noted on the drawing. If existing supports are not available, breakaway supports or supports behind guardrail shall be individually designed.

If a freeway/expressway has three or more directional lanes and it is necessary to close more than one lane, insert a tangent section (equal to twice the taper) between the end of the first lane closure and the beginning of the second. Dual ground-mounted W9-H4-144 signs shall be placed at the beginning of the taper for the second lane closure. If additional lanes are closed, the same process shall be repeated.

If the signs shown as dashed at the ramps do not exist, the designer may require them or similar signs as a part of the work.

MT-99.51 provides three distinct treatments for the upstream end treatment of the PCB. Wherever permanent concrete median barrier does not exist, the preferred end treatment is to use an impact attenuator as shown. Detail A shall be used whenever permanent concrete median barrier is encountered. The designer may choose to use the treatment as shown in Detail B considering the following:

1. The impact attenuator treatment can be used on any median width; Detail B can only be used on medians wider than 60 feet (18 meters).

2. The impact attenuator treatment does not reduce the clear zone in advance of the impact attenuator; Detail B restricts the clear zone for the 450-foot (137-meter) taper in the median.

3. The impact attenuator treatment will typically not require any additional grading of the median; Detail B requires the median to have foreslopes 10:1 or flatter from the edge of the left shoulder to the median. This may require drainage changes.

4. The impact attenuator treatment should typically be more economical.

5. The 30 feet (9 meters) offset to the beginning of the PCB, as shown in Detail B, may not always be sufficient **(see L&D Manual Volume One, Section 307)**. If the roadway curves to the right and the curvature exceeds 2.5 degrees (radius is less than 4100 feet (1250 meters)) the offset shall be increased in accordance with ***Table 697-9***.

   The length of PCB beyond the shoulder shall also be increased proportionately to maintain the 15:1 taper relative to edge of pavement.

The designer, not the contractor, must determine when to use each type of end treatment and note this in the Maintenance of Traffic Plan.

For **SCD MT-99.50**, all items will be included for payment under **Item 614 Maintaining Traffic**, except the following:

Item 630,	Sign, Extrusheet	Square Foot	(square meter)
Item 630,	Sign, Overlay	Square Foot	(square meter)
Item 630,	Ground Mounted Supports, _____ Beam	Foot (Meter)	
Item 630,	Breakaway Beam Connection	Each	
Item 630,	Ground Mounted Beam Support Foundation	Each	
Item 614,	Work Zone Edge Line, Class I (By Type)	Mile (kilometer)	
Item 614,	Work Zone Raised Pavement Marker	Each	

For **SCD MT-99.51**, all items will be included for payment under **Item 614 Maintaining Traffic**, except the following:

Item 614,	Work Zone Edge Line, Class I (By Type)	Mile (Kilometer)
Item 614,	Work Zone Transverse Line, Class I (By Type)	Foot (Meter)
Item 614,	Work Zone Raised Pavement Marker	Each
Item 614,	Barrier Reflector	Each
Item 614,	Work Zone Impact Attenuator	Each
Item 614,	Object Marker	Each
Item 622,	Portable Concrete Barrier, ____" (____ mm)	Foot (Meter)
Item 630,	Signs, Extrusheet	Sq. Ft. (Square Meter)
Item 630,	Signs, Overlay	Sq. Ft. (Square Meter)
Item 630,	Ground-Mounted Support, _____ Beam	Foot (Meter)
Item 630,	Breakaway Beam Connection	Each
Item 630,	Ground-Mounted Beam Support Foundation	Each

641-18 <u>Gates and Barricades (MT-101.60)</u>

The type of closure shown in **SCD MT-101.60** will typically be used in two different situations:

1. The closure seals off a road from which through traffic has been detoured upstream. In this case,

only local traffic is expected on the approach to the closure, although this traffic might still be appreciable if the detour begins some distance upstream. Any traffic approaching the closure must be adequately warned and given an ample opportunity to stop. The minimum advance warning treatment is three signs. They are supplemented with Type A flasher warning lights. The signs will be dual installations on a four-lane divided road and the designer may insert a **Plan Note** requiring dual installations on other roads.

2. The closure is used with an adjacent run-around or on a limited access highway. All of the traffic is required to exit upstream of the physical closure, such as is shown on **SCDs MT-99.50 and 99.51**, thus removal of all traffic from the approach is accomplished away from the gates and barricades closure and no other advance warning is needed adjacent to the closure. The appropriate advance Warning Signs for the detour should be shown in the plans.

When a closure will be implemented on a road with exceptionally wide right-of-way (i.e., two-lane road on future four-lane divided right-of-way) it may be prudent to limit the width of the barricades by **Plan Note**.

All elements of the gates and barricades closure, including any advance Warning Signs, will be included in the lump sum of **Item 614 Maintaining Traffic**.

641-19 Transition Plans for Use of Shoulder (MT-102.10 and 102.20)

When the work involves closing a lane(s) and a capacity analysis indicated that it is necessary to maintain more lanes of traffic than would remain after closing the lane(s), this drawing provides for use of the shoulder to maintain traffic. If the encroachment into the traveled lane is 2 feet (0.6 meters) or less use a lane width reduction.

Lane use cross sections should be shown in the plan indicating the number of lanes and the width of each. Normally, all lanes should be shifted.

To help keep the traffic in the proper lanes, Work Zone Solid Lane Lines are used through the transition area.

SCD MT-102.10 addresses the use of this shoulder transition to maintain traffic when portable concrete barrier (PCB) is used and **SCD MT-102.20** addresses the use of this traffic control when drums are used to close off the work area. The criteria between using PCB or drums should be based on the drop-off policy as well as consideration of traffic volumes, truck volumes, speed, duration of work and consideration of the degree of hazard.

The transition should be designed to maintain, as much as possible, the existing speed limit; however, if available space is limited, and a local speed reduction is desired, Speed Advisory signs can be added to the W1-4a, W1-4b or W1-4c.

The existing shoulders must be checked for smoothness, structural adequacy and clearance to structures. Reconstruction may be necessary to assure that they are adequate for the traffic. Plans should provide details of the shoulder work needed. Appropriate bid items shall be included in the plan.

When existing lighting is not available and the transition plan will be used for over fourteen days, a temporary lighting system shall be used for the tapers. Continuous lighting of the work area between tapers is only required when the tapers are provided with temporary lighting and the distance between lighted tapers (X) is less than 2000 feet (610 meters). **Plan Note 642-39** ***(Section 642-39)*** should be used.

It is intended that separate bid items be included for the following items:

Item 614,	Work Zone Solid Lane Lines, Class I, (By Type)	Mile (Kilometer)
Item 614,	Work Zone Edge Lines, Class I, (By Type)	Mile (Kilometer)
Item 622,	Portable Concrete Barrier, ____ “, (____ mm)	Foot (Meters)
Item 614,	Work Zone Lighting System	Each
Item 614,	Barrier Reflector (By Type)	Each
Item 614,	Work Zone Curb Marking	
Item 614,	Object Marker	Each

The lump sum for **Item 614 Maintaining Traffic** will cover all other work needed to place, maintain and remove the shoulder transitions including:

- Temporary signs and supports
- Drum and other channelizing devices
- Flashers and lights on signs
- Removal and replacement of raised pavement marker reflectors
- Removal of conflicting existing or work zone pavement markings
  (this is specifically incidental to **Item 614 Work Zone Pavement Markings**)

When traffic will be on a shoulder near to structure parapets or guardrail, plan quantities may also be needed for Bridge End Markers, additional barrier reflectors (spacings of 25 feet (7.6 meters) when traffic is close to these barriers).

641-20 Temporary Sign Support (MT-105.10 and 105.11)

SCDs MT-105.10 and 105.11 provide requirements for temporary sign supports. These drawings shall be used on all projects.

Normally, all temporary sign support items will be incidental to the lump sum bid for **Item 614 Maintaining Traffic**.

The designer should field check proposed sign locations which may be required to implement the various traffic control schemes shown in the plans. The check should determine if the site will be adequate for an appropriate temporary support and should consider any potential conflicts with existing signs. The plans may require the removal, covering or modification of the legend of existing signs, particularly overhead signs which establish lane use.

641-21 Detour of Pedestrians (MT-110.10, 110.20 and 110.30)

Pedestrian considerations are addressed in ***Section 603-2 and 640-25***. When it has been determined that a detour should be provided for pedestrian traffic, **SCDs MT-110.10, 110.20 and/or 110.30** shall be used.

641-22 New or Revised Traffic Control Signals (MT-120.00)

Prior to activating a new traffic signal, the public shall be given advance notice of the activation by use of special signing. This signing is shown in **SCD MT-120**. **MT-120** is to be provided in all plans which require the activation of a new traffic signal.

641-23 Transition Area Delineation (MT-99.30 and 99.31)

SCDs MT-99.30 and MT-99.31 are intended for use on projects which have either a lane shift of 4 feet (1.2 m) or more, or a crossover as part of the maintenance of traffic scheme. The drawings depict the following two methods of delineation for the transition areas in these situations:

1. Method A – Full pavement markings using 873 Wet Reflective Removable Tape.

2. Method B – Full pavement markings using 740.06 Type I work zone pavement marking material supplemented with work zone raised pavement markers.

The intent is to give the contractor the option to provide delineation using either Method A or Method B. This option may be superseded by specifying in the plans that Method B shall be used. However, limiting delineation exclusively to use of Method A shall not be permitted.

The transition area is generally considered to begin 300 feet (90 meters) in advance of the beginning of the shift taper or crossover and to end 300 feet (90 meters) beyond the termination of the shift taper or crossover. If it is necessary to revise the lengths of these approach distances, the **Plan Note *(Section 642-46)*** shall be revised accordingly. If the approach distances vary among the several approach distances within the plans, the limits of each transition area within the plans shall be specified individually.

642 PLAN NOTES

642-1 General

Typical **Plan Notes** have been consolidated here for convenience in preparing plans. The number used for the **Plan Note** will be the same as the section number. When a **Plan Note** revises the material or contractor requirements from that which is specified in the **CMS**, both the note and the bid items will be "as per plan." Where there are design instructions pertaining to a specific note, they are listed at the end of the note. These notes may be modified to further define the conditions of a project or maintaining agency. Each note is accompanied by a "Designer Note" in an attempt to give some guidance as to when the note should be used.

In keeping with the traditional format of **Plan Notes**, various format changes are used here that are not typical throughout the **TEM**, e.g., the terms Contractor and Engineer are capitalized.

642-2 Item 614, Maintaining Traffic

The text of this note will depend on specifics of the project.

Designer Note: Most traffic control plans should include an "Item 614, Maintaining Traffic" note that contains the following:

1. A description of how traffic will be maintained throughout the construction life of the project, including any limitations or restrictions.

2. Descriptions of all items that are to be performed under **CMS Item 614**.

3. A closing paragraph indicating the method of payment ***(see Plan Note 642-12)***.

642-3 Item 614, Maintaining Traffic (At All Times)

A minimum of ___ lane(s) of traffic in each direction shall be maintained at all times by use of the existing pavement, the completed pavement, Item 502 Structure for Maintaining Traffic, Item 615 Pavement for Maintaining Traffic, Item 615 Roads for Maintaining Traffic, and temporary surfaces using Items 410 and 614.

Designer Note: This note should be edited to include only items pertinent to each specific project.

642-4 Item 614, Maintaining Traffic (Time Limitation on a Detour)

A minimum of one lane of traffic in each direction shall be maintained at all times, except for a period not to exceed _____ consecutive calendar days, when through traffic may be detoured as shown on sheet _____. Liquidated damages shall be assessed (in accordance with CMS108.07)(in the amount of $ _____ per day) for each calendar day the roadway remains closed to traffic beyond the specified limit.

Designer Note: This note shall be used if there is a time limitation placed on the detour. Liquidated damages per **CMS 108.07** are normally specified. If a larger amount is desired, written documentation of the reason and justification for the amount shall be submitted for review. The appropriate wording in parentheses should be used in the note.

642-5 Item 614, Maintaining Traffic (Winter Time Limitations)

All existing lanes shall be open to traffic between November _____ and April _____. November _____ shall be considered to constitute an interim completion date and liquidated damages shall be assessed in accordance with CMS 108.07 for each calendar day that all lanes are not open and available to traffic.

Designer Note: This note shall be used when winter traffic limitations are required.

642-6 Item 614, Maintaining Traffic (Lanes Open During Holidays or Special Events)

No work shall be performed and all existing lanes shall be open to traffic during the following designated holidays or events:

Christmas	Fourth of July
New Years	Labor Day
Memorial Day	Thanksgiving
(Other Holiday or Event)	

The period of time that the lanes are to be open depends on the day of the week on which the holiday or event falls. The following schedule shall be used to determine this period:

Day of the Week	Time All Lanes Must Be Open to Traffic
Sunday	12:00N Friday through (12:00N or 6:00 AM) Monday
Monday	12:00N Friday through (12:00N or 6:00 AM) Tuesday
Tuesday	12:00N Monday through (12:00N or 6:00 AM) Wednesday
Wednesday	12:00N Tuesday through (12:00N or 6:00 AM) Thursday
Thursday	12:00N Wednesday through (12:00N or 6:00 AM) Monday
Friday	12:00N Thursday through (12:00N or 6:00 AM) Monday
Saturday	12:00N Friday through (12:00N or 6:00 AM) Monday

No extensions of time shall be granted for delays in material deliveries, unless such delays are industry-wide, or for labor strikes, unless such strikes are area-wide.

Should the Contractor fail to meet any of these requirements, the Contractor shall be assessed liquidated damages in (the amount of $ ____ per day)(in accordance with CMS 108.07).

Designer Note: This note shall be used when lanes must be open to traffic during holidays or special events. Liquidated damages per **CMS 108.07** are normally specified. If a larger amount is desired, written documentation of the reason and justification for the amount shall be submitted. The appropriate wording in parentheses should be used in the note.

642-7 Item 614, Maintaining Traffic (Lane Closure/Reduction Required)

Length and duration of lane closures and restrictions shall be at the approval of the Engineer. It is the intent to minimize the impact to the traveling public. Lane closures or restrictions over segments of the project in which no work is anticipated within a reasonable time frame, as determined by the Engineer, shall not be permitted. The level of utilization of maintenance of traffic devices shall be commensurate with the work in progress.

Designer Note: This note shall be added to the **Item 614 Maintaining Traffic** note ***(Section 642-2)*** if lane closures, or restrictions are required.

642-8 Item 614, Maintaining Traffic (Notice of Closure Sign)

Notice of Closure signs, as detailed in these plans, shall be erected by the Contractor at least one week in advance of the scheduled road or ramp closure. The signs shall be erected on the right-hand side of the road/ramp facing traffic. They shall be placed so as not to interfere with the visibility of any other traffic control signs. On roadways, they should be erected at the point of closure. The signs may be erected anywhere on ramps as long as they are visible to the motorists using the ramp. On entrance ramps, the sign shall be erected well in advance of the merge area to avoid distracting motorists.

Designer Note: The use of Notice of Closure signs in the plan and this note is at the discretion of the designer. Details of these closure signs must be in conformance with the **OMUTCD** and be included in the plans. The last line of the sign shall list a phone number which a motorist may call for additional information. This is to be a specific office within the **District** (or municipality) rather than the general switch board number. The person answering this phone should have a one-page summary of critical project data, and possibly a portion of a map showing the closure and planned detour route. Information shown would normally include such information as: contract identification, scheduled completion, type of improvement, why the closure is necessary, other closures or lane reductions planned as a part of the project and their timing and other data which would help a motorist deal with the construction period.

642-9 Item 614, Maintaining Traffic (Contingency Quantities)

The following estimated quantities have been included in the General Summary for use as directed by the Engineer for the maintenance of traffic.

Item	410, Traffic Compacted Surface, Type A or B	_____ Cu. Yd. (Cu. Meter)
Item	410, Traffic Compacted Surface, Type C	_____ Cu. Yd. (Cu. Meter)
Item	614, Asphalt Concrete for Maintaining Traffic	_____ Cu. Yd. (Cu. Meter)
Item	616, Water	_____ M. Gal. (Cu. Meter)

Designer Note: This note shall be used when quantities of **CMS Items 410, 614, 616**, or other items, are added to the plan as contingency quantities. Contingency quantities for maintaining traffic are normally required when through or local traffic is being maintained on a facility during construction. Quantities of **CMS Item 614** Asphalt Concrete or **CMS Item 410** will depend on the number of drives and pavement cuts required because of drainage or utilities. Generally, every 50 cubic yards of **CMS Item 410** will require 1 M. Gal. of **CMS Item 616**, Water (minimum of 50 M. Gal.) (every 40 cubic meters of **CMS Item 410** will require 4 cubic meters of **CMS Item 616**, Water (minimum of 200 cubic meters)).

642-10 Item 614, Maintaining Traffic (ROAD CLOSED Sign)

The Contractor shall provide, erect and maintain standard 48 x 30 inches (1200 x 750 millimeters) ROAD CLOSED signs, sign supports, barricades, gates and lights, as detailed in SCD MT-101.60

at the following locations during periods in which the affected roads are closed to traffic.

(List locations, example - Loyal Road just West of SR 1000 intersection.)

Designer Note: Unless shown in a detail elsewhere in the plan, this note should be included in the **Item 614 Maintaining Traffic** note ***(Section 642-2)*** on projects where ROAD CLOSED signs are to be used on major relocation projects in rural areas where crossroads are located an appreciable distance from the project. Normally, these signs are positioned at the first crossroad on each side of the relocation.

642-11 Item 614, Maintaining Traffic (Signs and Barricades)

The Contractor shall provide, erect and maintain signs and sign supports, as detailed in the Ohio Manual of Uniform Traffic Control Devices, and Type III barricades of the type and location as follows:

(List type and locations.)

Designer Note: Unless shown in a detail elsewhere in the plan, this note should be included in the **Item 614 Maintaining Traffic** note ***(Section 642-2)*** on projects where signs and barricades are to be provided.

642-12 Item 614, Maintaining Traffic (Closing Paragraph for Note)

All work and traffic control devices shall be in accordance with CMS 614 and other applicable portions of the specifications, as well as the Ohio Manual of Uniform Traffic Control Devices. Payment for all labor, equipment and materials shall be included in the lump sum contract price for Item 614, Maintaining Traffic, unless separately itemized in the plan.

Designer Note: This note should be used as a closing for the **Item 614 Maintaining Traffic** note ***(Section 642-2)***.

642-13 Placement of Asphalt Concrete

Two-way traffic shall be maintained at all times except that one-way traffic will be permitted for minimum periods of time consistent with the requirements of the specifications for protection of completed asphalt concrete courses.

Designer Note: This note shall be used on projects involving resurfacing while traffic is maintained.

642-14 Trench for Widening

Trench excavation for base widening shall be only on one side of the pavement at a time. The open trench shall be adequately maintained and protected with drums or barricades at all times. Placement of proposed subbase and base material shall follow as closely as possible behind excavation operations. The length of widening trench which is open at any one time shall be held to a minimum and shall at all times be subject to approval of the Engineer.

Designer Note: This note shall be used on widening projects where traffic is maintained. The designer should refer to the **Traffic Plan Insert Sheet (PIS) 2010190**, Dropoffs in Work Zones, to determine the necessary treatment or protection to be specified in the plan. This **Traffic PIS** is available from the **Office of Traffic Engineering** and can be accessed from the **OTE** or **Design Reference Resource Center (DRRC)** web sites.

642-15 Overnight Trench Closing

The base widening shall be completed to a depth of no more than _____ inches (millimeters) below the existing pavement by the end of each work day. No trench shall be left open overnight except for a short length (25 feet or less (7.5 meters or less)) of a work section at the end of the trench. In case work must be suspended because of inclement weather or other reasons, the trench for the uncompleted base widening shall be backfilled at the direction of the Engineer.

Designer Note: This note shall be used for projects involving base widening where traffic is maintained. The allowable depth is calculated to the bottom of the first surfacing course. The designer should refer to the **Traffic PIS 2010190**, Dropoffs in Work Zones, to determine the necessary treatment or protection to be specified in the plan. This **Traffic PIS** is available from the **Office of Traffic Engineering** and can be accessed from the **OTE** or **Design Reference Resource Center (DRRC)** web sites.

642-16 Concrete Median Barrier Replacement

Removing, grading and installing the replacement barrier in a continuous operation shall be limited to _____ linear feet (meter) and shall at all times be subject to the approval of the Engineer. The Engineer shall be satisfied that all installations will afford maximum protection for traffic.

Designer Note: This note shall be used when replacing existing concrete median barrier. The length of this operation should be decided in conjunction with the **District Highway Management Administrator**.

642-17 Guardrail Replacement

This note has been incorporated into the 2002 **CMS**.

642-18 Item 614 - Law Enforcement Officer (With Patrol Car)

In addition to the requirements of CMS 614 and the Ohio Manual of Uniform Traffic Control Devices (OMUTCD), a uniformed law enforcement officer (and official patrol car with working top-mounted emergency flashing lights) shall be provided for controlling traffic for the following tasks:

- For lane closures: during initial set-up periods, tear down periods, substantial shifts of a closure point or when new lane closure arrangements are initiated.
- During the entire advance preparation and closure sequence where complete blockage of traffic is required.
- During a traffic signal installation.

Law enforcement officers (LEOs) should not be used where the OMUTCD intends that flaggers be used. The LEOs are considered to be employed by the Contractor and the Contractor shall be responsible for their actions. Although they are employed by the Contractor, the Engineer shall have control over their placement. The official patrol car shall be a public safety vehicle as required by the Ohio Revised Code. The Contractor shall make arrangements for these services with: (list law enforcement agency, address and telephone number).

Law enforcement officers (with patrol car) required by the traffic maintenance tasks above shall be paid for on a unit price (hourly) basis under Item 614, Law Enforcement Officer (With Patrol Car). The following estimated quantities have been carried to the General Summary.

Item 614, Law Enforcement Officer _____ Hours
Item 614, Law Enforcement Officer With Patrol Car _____ Hours

The hours paid shall include minimum show-up time required by the law enforcement agency involved.

If Contractors wish to utilize LEOs for flagging and traffic control other than for that required in these plans, they may do so at their own expense. Payment for the excess above the contract requirements will be included under Item 614, Maintaining Traffic.

Designer Note: See **L&D Manual Volume One, Section 502.17** for additional information. The three tasks shown are generalizations. The plans shall clearly specify when and where the LEO is to be utilized. This note should be edited to conform with the project requirements.

642-19 Dust Control

The Contractor shall furnish and apply water for dust control as directed by the Engineer. The following contingency quantities have been included for dust control purposes:

Item 616, Water _____ M. Gal. (Cu. Meter)

Designer Note: For every cubic yard (cubic meter) of earthwork (embankment plus excavation), use between 0.002 M. Gallon (0.01 cubic meter) and 0.004 M. Gal (0.02 cubic meter) of water. The lower rate should be used for small and/or rural projects and the larger rate should be used for large and/or urban projects.

642-20 Work Zone Markings and Signs

The following estimated quantities have been carried to the General Summary for use at locations identified by the Engineer for work zone pavement markings and signs per the requirements of CMS 614.04 and 614.11.

Designer Note: A breakdown of the various types of signs and pavement markings should be included (examples: Item 614, Work Zone Marking Sign; Item 614, Work Zone Lane Line, Class ___, ___, Item 614, Work Zone Stop line, Class ___, ___, etc.).

642-21 Item 622, Portable Concrete Barrier, 50" (1270 mm), As Per Plan

This work shall consist of furnishing, installing, maintaining, and subsequently removing a 50 inch (1270 millimeter) Portable Concrete Barrier at the locations shown on the plans. For details, see SCD RM-4.1.

Portable Concrete Barrier, 32 inches (813 millimeters) high with an 18 inch (457 millimeter) minimum height glare screen may be used at the option of the Contractor. The glare screen shall be constructed using one of the following systems or an approved equal:

Carsonite Modular Glare Screen
Carsonite International
605 Bob Gifford Blvd.
Early Branch, South Carolina 29916 702-883-5104 or 800-648-7974

Trinity Glarefoil
Trinity Industry
1170 N. State St.,
Girard, Ohio 44420 330-545-4373

Paddle or intermittent type glare screens shall be designed using a 20 degree cut-off angle based on tangent alignment. That spacing shall be used throughout the barrier length without regard to barrier curvature.

The glare screen system shall be securely fastened to the 32-inch (813 millimeter) Portable Concrete Barrier using the hardware and procedures specified by the manufacturer.

Payment shall include all labor, material, and equipment necessary to perform the work and shall be paid for at the contract price per foot (meter) for Item 622, Portable Concrete Barrier, 50 inch (1270 millimeter), as per plan.

Designer Note: A plan detail will be required for this item. Additional information may be obtained by contacting the **Office of Roadway Engineering Services**.

642-22 Item 614, Replacement Sign

Flatsheet signs furnished by the Contractor in accordance with the requirements of the plans, specifications and proposal which become damaged by traffic for reasons beyond the control of the Contractor shall be replaced in kind when ordered by the Engineer. Replacement signs shall be new. Other materials may be in used, but good, condition subject to approval by the Engineer.

Payment for the new signs shall be made at the contract price per square foot (square meter) for Item 614, Replacement Sign, and shall include the cost of removing and disposing of damaged signs, hardware and supports, and providing the necessary replacement hardware, supports, etc.

An estimated quantity of _____ square feet (square meters) has been provided in the General Summary.

Designer Note: This note shall be used on all four-lane, high-speed projects which will last longer than six months, and on other projects where there is a high probability that a number of signs will be damaged during construction.

642-23 Item 614, Replacement Drum

Drums furnished by the Contractor in accordance with the requirements of the plans, specifications and proposal which become damaged by traffic for reasons beyond the control of the Contractor shall be replaced in kind when ordered by the Engineer. Replacement drums shall be new.

Payment for the new drums shall be made at the contract price per each for Item 614, Replacement Drum, and shall include the cost of removing and disposing of the damaged drum, and providing and maintaining the replacement drum in accordance with the contract requirements for the original drum.

An estimated quantity of _____ each has been provided in the General Summary.

Designer Note: This note shall be used on all four-lane high-speed projects which will last longer than six months, and on other projects where there is a high probability that a number of drums will be damaged during construction.

642-24 Item 614, Work Zone Speed Limit Sign

The Contractor shall furnish, install, maintain, cover during suspension of work, and subsequently remove Work Zone Speed Limit (R2-1) (_____ speed limit) signs and supports within the work limits in accordance with the following requirements:

The Contractor shall cover or remove any existing Speed Limit signs within the reduced Speed Zone. These signs shall be restored during suspension or termination of the reduced speed limit. The expense of covering or removal and restoration of existing Speed Limit or Minimum Speed Limit signs shall be included in the pay item for the Work Zone Speed Limit signs.

The Work Zone Speed Limit signs may be erected or uncovered no more than four hours before the actual start of work. The signs shall be removed or covered no later than four hours following restoration of all lanes to traffic with no restrictions, or sooner as directed by the Engineer. Temporary sign covering and uncovering due to temporary lane restorations shall be guided by the four-hour limitations stated above. Such lane restorations should be expected to remain in effect for 30 or more days, such as during winter shut-downs.

(The Contractor shall erect a Work Zone Speed Limit sign in advance of any lane restriction expected to last at least 30 consecutive calendar days, or as directed by the Engineer. The sign shall be mounted on both sides of divided highways. The first work zone speed limit sign shall be placed 500 feet (150 meters) in advance of the lane reduction taper or at a point wherever construction begins, whichever comes first. The sign shall be mounted on the right side, 250 feet (75 meters) in advance of the lane reduction taper on undivided highways. The sign shall be repeated, on the side nearest traffic, every 1 mile (1.6 kilometers) for 55 mph zones and every one-half mile (0.8 kilometers) for 50 mph and 45 mph zones. These signs shall also be erected immediately after each open entrance ramp within the zone.)

Reduced Speed Ahead signs shall be erected in advance of the speed reduction, approximately 1300 feet (390 meters) on multi-lane highways and 500 feet (150 meters) on 2-lane highways.

A sign(s) to indicate the resumption of the statutory speed limit shall be erected at the end of any reduced Speed Zone. R2-1 (Speed Limit) signs shall be used on undivided roadways. R2-1 (Speed Limit) and R2-H2a signs shall be used on divided roadways. When used the R2-1 and R2-H2a signs shall be mounted side-by-side on separate supports. The Contractor may use signs and supports in used, but good, condition provided the signs meet current ODOT specifications. Sign faces shall be reflectorized with Type G sheeting complying with the requirements of CMS 730.19.

Work Zone Speed Limit signs shall be mounted on two Item 630, Ground Mounted Supports, No. 3 posts.

Work Zone Speed Limit signs and supports will be measured as the number of sign installations, including the signs and necessary supports. If a sign and support combination is removed and reerected at another location within the project due to changes in the Speed Zone directed by the Engineer, it shall be considered another unit.

Payment for accepted quantities, complete in place, will be made at the contract unit price. Payment shall be full compensation for all materials, labor, incidentals and equipment for furnishing, erecting, maintaining, covering during suspension of work, and removing the signs and supports. The following estimated quantity has been carried to the General Summary.

Item 614, Work Zone Speed Limit Sign _____ Each

The signs will be placed at the following locations:

Designer Note: This note shall be included in projects where speed limits are reduced in accordance with ***Section 640-18.2.***

When this note is used, it should be accompanied by the **Prima Facie Speed Limit Note** on the Title Sheet **(L&D Manual Volume Three, Section 1302.12.4)**.

The fourth paragraph shall only be used when the sign locations are not itemized in the note.

Sufficient numbers of the Work Zone Speed Limit signs shall be included to cover the entire project at the spacing required by the note plus one for each entrance ramp, for each direction. For example, for a 2.33 mile (3.75 kilometer) project on an urban Interstate freeway:

Spacing = 0.5 miles (800 meters)
2.33/0.5 = 4.66 signs or 5 signs (3750/800 = 4.69 signs or 5 signs)
Both sides of roadway = 5 x 2 = 10 signs
Both directions of roadway = 10 x 2 = 20 signs
Plus entrance ramps = 20 + 4 = 24 signs
Total number of Work Zone Speed Limit signs = 24

642-25 Designated Local Detour Route

In addition to the official, signed Detour Route, a local route has been determined to be the secondary, unsigned Detour Route or "designated local Detour Route." This route is shown on Sheet No. ____. During the time that traffic is detoured, the Contractor shall maintain this route in a condition which is reasonably smooth and free from holes, ruts, ridges, bumps, dust and standing water. Once the detour is removed and traffic returned to its normal pattern, the designated local Detour Route shall be restored to a condition that is equivalent to that which existed prior to its use for this purpose. All such work shall be performed when and as directed by the Engineer.

The following estimated quantities are provided for use as directed by the Engineer to maintain and subsequently restore the designated local Detour Route.

Item 301, Asphalt Concrete Base, PG 64-22	_____ Cu. Yd. (Cu. Meter)
Item 304, Aggregate Base	_____ Cu. Yd. (Cu. Meter)
Item 448, Asphalt Concrete Surface Course, Type 1, PG 64-22	_____ Cu. Yd. (Cu. Meter)
Item 407, Tack Coat	_____ Gal. (Liter)
Item 408, Prime Coat	_____ Gal. (Liter)
Item 614, Asphalt Concrete for Maintaining Traffic	_____ Cu. Yd. (Cu. Meter)
Item 616, Water	_____ M. Gal. (Cu. Meter)
Item 617, Compacted Aggregate, Type A	_____ Cu. Yd. (Cu. Meter)
Item 617, Water	_____ M. Gal. (Cu. Meter)
Item 642, Center Line	_____ Mile (Kilometer)

Designer Notes:

1. Procedures relative to Detours and designated local Detour Routes are set forth in **SOP OPS-103**, Detours and **SOP OPS-104**, Maintenance & Repair of Local Roads and Streets Used as Official Detour Routes, Designated Local Detour Routes, or Haul Roads.

2. The list of payment items is included for example purposes only. It is not meant to be all-inclusive of the Items that might be required. The designer must provide items for each individual project as may be appropriate for the work involved.

3. All pay items listed in the above note should be carried to the General Summary under the Maintenance of Traffic heading.

642-26 Item 614, Barrier Reflectors And/or Object Markers

Barrier Reflectors and/or Object Markers shall be installed on all Portable Concrete Barrier used for traffic control. Barrier Reflectors, Object Markers and their installation shall conform to CMS

626, except that the spacing shall be 50 feet (15 meters). An estimated quantity of _____ each of Item 614 Barrier Reflector, Type B and _____ each of Item 614 Object Marker, ____-way have been provided and carried to the General Summary.

Designer Note: This note shall be added when Item 614, Barrier Reflectors and/or Object Markers are specified**.**

642-27 Work Zone Increased Penalties Sign (R11-H5a)

R11-H5a-48 signs shall be furnished, erected, and maintained in good condition and/or replaced as necessary and subsequently removed by the Contractor. Signs shall be mounted at the appropriate offsets and elevations as prescribed by the Ohio Manual of Uniform Traffic Control Devices. They shall be maintained on supports meeting current safety criteria.

The signs may be erected or uncovered no more than four hours before the actual start of work. The signs shall be removed or covered no later than four hours following restoration of all lanes to traffic with no restrictions, or sooner as directed by the Engineer. Temporary sign covering and uncovering due to temporary lane restorations shall be guided by the four-hour limitations stated above. Such lane restorations should be expected to remain in effect for 30 or more consecutive calendar days, such as during winter shut-downs.

(The signs shall be dual mounted. The first sign shall be placed between the ROAD WORK AHEAD (W20-1) sign and the next sign in the sequence. Signs shall be erected on each entrance ramp and every 2 miles (3 kilometers) through the construction work limits.)

The Contractor may use signs and supports in used, but good, condition provided the signs meet current ODOT specifications. Sign faces shall be reflectorized with Type G sheeting complying with the requirements of CMS 730.19.

Work Zone Increased Penalties signs and supports will be measured as the number of sign installations, including the sign and necessary supports. If a sign and support combination is removed and reerected at another location as directed by the Engineer, it shall be considered another unit.

Payment for accepted quantities, complete, in place will be made at the contract unit price. Payment shall be full compensation for all materials, labor, incidentals and equipment for furnishing, erecting, maintaining, covering during suspension of work and removal of the sign and support.

Item 614, Work Zone Increased Penalties Sign _____ Each

Work Zone Increased Penalties signs will be placed at the following locations:

Designer Note: As noted in ***Section 605-4.3***, this sign shall be used for construction zones on multi-lane divided highways where the work is expected to last thirty days or more, the work length is at least 0.50 miles (0.80 kilometers), and the work is stationary. See ***Section 605-4.3*** for other information about the use of this signing.

The third paragraph shall only be used when the sign locations are not itemized in note.

642-28 Earthwork for Maintaining Traffic

The following quantities have been included in the plan for information only:

Excavation for Maintaining Traffic _____ Cu. Yd. (Cu. Meter)
Embankment for Maintaining Traffic _____ Cu. Yd. (Cu. Meter)

Designer Note: This note should be used in conjunction with CMS Item 615, Roads for Maintaining Traffic. The calculations for the above quantities may be shown on the cross-sections or on a separate letter-size sheet that is attached to the LD-4 form.

642-29 Floodlighting

Floodlighting of the work site for operations conducted during nighttime periods shall be accomplished so that the lights do not cause glare to the drivers on the roadway. To ensure the adequacy of the floodlight placement, the Contractor and the Engineer shall drive through the work site each night when the lighting is in place and operative prior to commencing any work. If glare is detected, the light placement and shielding shall be adjusted to the satisfaction of the Engineer before work proceeds.

Payment for all labor, equipment and materials shall be included in the lump sum contract price for Item 614, Maintaining Traffic ***(Section 642-2)***.

Designer Note: The note shall be used on projects that will have work performed during the nighttime hours.

642-30 Item 614, Work Zone Impact Attenuator (Unidirectional or Bidirectional)

This item shall consist of furnishing and installing either of the following impact attenuators:

1. The QuadGuard CZ, (24 inches (610 millimeters) wide six-bay) work zone impact attenuator manufactured by Energy Absorption Systems, Inc., One East Wacker Drive, Chicago, IL 60601 (telephone: 312-467-6750).

   The length of the six-bay QuadGuard CZ is 20'-9" (6.33 meters). Installation shall be at the locations specified in the plans, in accordance with the manufacturer's specifications as detailed on the following pre-approved shop drawings:

Drawing Number	Drawing Name	Drawing/ Revision Date	ODOT Approval Date
QSCZCVR-T4	QuadGuard CZ System for Construction Zones	5/13/99 Rev. J	8/27/99
35-40-10	QuadGuard System Concrete Pad, CZ, QG	11/19/97 Rev. D	8/27/99
35-40-16	QuadGuard System Backup Assembly, CZ, QG	7/30/99 Rev. F	8/27/99
354051z	QuadGuard CZ System Nose Assembly, CZ, QG, 24, 30, 36	5/17/99	8/27/99
35-40-18	Transition Assembly, 4 Offset, QG	6/25/99 Rev. F	8/27/99
35400260	QuadGuard System PCMB Anchor Assembly	11/19/97 Rev. C	8/27/99

2. The TRACC (Trinity Attenuating Crash Cushion) manufactured by Trinity Industry, 1170 N. State Street, Girard, Ohio 44420 (telephone: 330-545-4373).

   The TRACC is 21'-0" (6.4 meters) long and 2'-7" (0.8 meter) wide. Installation shall be at the locations specified in the plans, in accordance with the manufacturer's specifications as detailed on the following pre-approved shop drawings:

Drawing Number	Drawing Name	Drawing/ Revision Date	ODOT Approval Date
SS450	Crash-cushion Attenuating Terminal Plan, Elevation & Sections	3/12/99 Rev. 1	8/27/99
SS455	TRACC Transition to W-beam Median Barrier Plan, Elevation & Sections	2/18/99	8/27/99
SS461	TRACC Transition to Concrete Safety Shape Barrier Plan, Elevation & Sections	6/30/99 Rev. 1	8/27/99
SS462	TRACC Transition to Concrete Barrier Single Slope Plan, Elevation & Sections	6/30/99	8/27/99

3. The GREAT CZ impact attenuator manufactured by Energy Absorption Systems, Inc.

   This attenuator may be used until January 1, 2007 if the item was purchased before October 1, 1998 and is in the Contractor's inventory.

The Contractor shall provide a replacement unit when an impact is severe enough to require complete replacement of the attenuator. The Contractor shall have a spare parts package available on the project site at all times when an attenuator is in place. The Contractor shall provide a minimum of one complete spare parts package for every one to six units installed on the project site. For example, five installed units require one spare parts package and seven installed units require two spare parts packages.

When bidirectional designs are specified, the Contractor shall supply appropriate transitions. Payment for the above work shall be made at the unit price bid for Item 614, Work Zone Impact Attenuator, (Unidirectional or Bidirectional), Each, and shall include all labor, tools, equipment and materials necessary to construct, maintain, repair, replace or relocate a complete and functional impact attenuator system, including all related backups, transitions, leveling pads, hardware and grading, not separately specified, as required by the manufacturer.

Designer Notes:

1. This note should be used for temporary protection of Type 5 Barrier Design Guardrail, Concrete Median Barrier, PCB and other narrow hazards (24 inches (610 millimeters) or less in width) located in work zones where speeds are over 40 miles per hour. When a work zone impact attenuator is needed to protect wider hazards or in work zones where speeds are 40 miles per hour or lower, the designer should specify **Item 614 Work Zone Impact Attenuator, QuadGuard CZ [(model #), (Unidirectional or Bidirectional)]** and add the corresponding note to the plans.

2. The length of need point is at the nose of the system; therefore, the entire length of the unit

can be deducted from the calculated length of need for the barrier.

3. The attenuator can be installed on a concrete pad or asphalt pavement. Consult the manufacturer's specifications for minimum pavement thicknesses.

4. Pre-approved shop drawings are reviewed and kept on file. Contact the **Office of Roadway Engineering Services** for the current Dwg/Rev. and ODOT Approval dates.

5. The QuadGuard CZ and TRACC are non-gating systems.

6. If cross slopes are steeper than 8 percent (12:1), or if the cross slope varies by more than 2 percent (1 degree) over the length of the unit, a leveling pad may be used.

7. Provisions shall be made for the rear fender panels to slide 30 inches (762 millimeters) rearward upon impact.

8. Bidirectional should be specified for locations where traffic is expected to be in opposing directions on either side of the attenuator. Unidirectional shall be specified when traffic is expected to move in the same direction on both sides of the attenuator.

642-31 Item 614, Work Zone Impact Attenuator, QuadGuard CZ ((Model #), (Unidirectional or Bidirectional))

This item shall consist of furnishing and installing a QuadGuard CZ work zone impact attenuator manufactured by Energy Absorption Systems, Inc., One East Wacker Drive, Chicago, IL 60601 (telephone: 312-467-6750).

Installation shall be at the locations specified in the plans, in accordance with the manufacturer's specifications as detailed on the following pre-approved shop drawings:

Drawing Number	Drawing Name	Drawing/ Revision Date	ODOT Approval Date
QSCZCVR-T4	QuadGuard CZ System for Construction Zones	5/13/99 Rev. J	8/27/99
35-40-10	QuadGuard System Concrete Pad, CZ, QG	11/19/97 Rev. D	8/27/99
35-40-16	QuadGuard System Backup Assembly, CZ, QG	7/30/99 Rev. F	8/27/99
354051z	QuadGuard CZ System Nose Assembly, CZ, QG, 24, 30, 36	5/17/99	8/27/99
35-40-18	Transition Assembly, 4 Offset, QG	6/25/99 Rev. F	8/27/99
35400260	QuadGuard System PCMB Anchor Assembly	11/19/97 Rev. C	8/27/99

The Contractor shall provide a replacement unit when an impact is severe enough to require complete replacement of the attenuator. The Contractor shall have a spare parts package available on the project site at all times when an attenuator is in place. The Contractor shall provide a

minimum of one complete spare parts package for every one to six units installed on the project site. For example, five installed units require one spare parts package and seven installed units require two spare parts packages.

When bidirectional designs are specified, the Contractor shall supply appropriate transitions. Payment for the above work shall be made at the unit price bid for Item 614, Work Zone Impact Attenuator, QuadGuard CZ ((Model #), (Unidirectional or Bidirectional)), Each, and shall include all labor, tools, equipment and materials necessary to construct, maintain, repair, replace or relocate a complete and functional impact attenuator system, including all related backups, transitions, leveling pads, hardware and grading, not separately specified, as required by the manufacturer.

Designer Notes:

1. This note should be used for temporary protection of Type 5 Barrier Design Guardrail, Concrete Median barrier, PCB and other fixed objects located in work zones where speeds are 40 miles per hour or lower and for the protection of hazards wider than 24 inches (610 millimeters), but less than 36 inches (915 millimeters) in work zones where speeds are over 40 miles per hour.

   As shown in ***Table 697-7***, the QuadGuard CZ comes in three widths, 24 inches (610 millimeters), 30 inches (760 millimeters), and 36 inches (915 millimeters). The six-bay unit is 22'-1" (6.74 meters) long and can be used in work zones where speeds are over 40 miles per hour. The three-bay unit is 13'-1" (4.00 meters) long and can be used in work zones where speeds are 40 miles per hour and lower.

   When a 24 inch (610 millimeters) wide six-bay QuadGuard CZ is needed, the designer should specify **Item 614, Work Zone Impact Attenuator, (Unidirectional or Bidirectional)** and add the corresponding note to the plans.

2. The length of need point is at the nose of the system; therefore, the entire length of the unit can be deducted from the calculated length of need for the barrier.

3. The QuadGuard CZ can be installed on a concrete pad or asphalt pavement. Consult the manufacturer's specifications for the minimum pavement thicknesses.

4. Pre-approved shop drawings are reviewed and kept on file. Contact the **Office of Roadway Engineering Services** for the current Dwg/Rev. and ODOT Approval dates.

5. The QuadGuard CZ is a non-gating system.

6. If cross slopes are steeper than 8 percent (12:1) or if the cross slope varies by more than 2 percent (1 degree) over the length of the unit, a leveling pad may be used.

7. Provisions shall be made for the rear fender panels to slide 30 inches (762 millimeters) rearward upon impact.

8. Bidirectional should be specified for locations where traffic is expected to be in opposing directions on either side of the attenuator. Unidirectional shall be specified when traffic is expected to move in the same direction on both sides of the attenuator.

642-32 <u>Note deleted, but space saved for future note.</u>

This note has been deleted.

642-33 Extra Advance Warning Signs (Note A)

An Extra Advance Warning Sign Group consists of two W20-1 (ROAD WORK AHEAD) signs, two W20-5 (RIGHT /LEFT LANE CLOSED AHEAD) signs with W16-3a Distance plates, and two W3-H7 (WATCH FOR STOPPED TRAFFIC) signs and required warning lights.

The Contractor shall provide, erect, maintain and remove Extra Advance Warning Sign Groups as shown on SCD MT-95.30 or MT-95.40 at the following distances in advance of the lane tapers with the appropriate W16-3a distance plates:

1) Lane Taper No. _____, Station _____, Phases _____ &_____; provide sign groups at _____ miles (kilometers) _____ miles (kilometers) and _____ miles (kilometers).

2) Lane Taper No. _____, Station _____, Phases _____ & _____; provide sign groups at _____ miles (kilometers), _____ miles (kilometers), _____ miles (kilometers), and _____ miles (kilometers).

(*Optional paragraph* - The Contractor shall have an additional Extra Advance Warning Sign Group (6 signs and 2 distance plates) available for use when directed by the Engineer. The distance plates for this group shall be able to be modified in the field to show appropriate whole miles to the lane taper.)

Payment for providing, erecting, maintaining and removing Extra Advance Warning Sign Groups shall be included in the lump sum bid for Item 614, Maintaining Traffic.

Designer Note: As noted in ***Section 641-5.2***, this note should be used to require extra Advance Warning Sign Groups if the queue resulting from a lane closure on a multilane divided highway is expected to extend beyond the normal ROAD WORK AHEAD sign (W20-1). See ***Section 641-5.2*** for further information.

642-34 Extra Advance Warning Signs (Note B)

An Advance Warning Sign Group consists of two W20-1 (Road Work Ahead) signs, two W20-5 (Right/Left Lane Closed Ahead) signs with W16-3a Distance plates, and two W3-H7 (Watch for Stopped Traffic) signs and required flashing lights.

The Contractor shall provide, erect, maintain and remove an Extra Advance Warning Sign Group as shown on SCD MT-95.40. The W16-3 Distance plates shall read " _____ MILES". The Right (Left) Lane Closed Ahead signs shall be located _____ miles (kilometers) from the beginning of the lane taper. Spacing of the other signs shall be as shown on SCD MT-95.40.

The Contractor shall provide, erect, maintain and remove an additional Extra Advance Warning Sign Group to provide additional warning for the anticipated traffic increase during the following national holidays: (appropriate holidays to be filled in as defined by policy and the specific needs of the project). These signs shall be erected no later than 1:00 p.m. the third day preceding the holiday or holiday weekend and not removed before 9:00 a.m. the third day subsequent to the holiday or holiday weekend. The signs shall be removed during the periods between holidays. The W16-3a Distance plates shall read "_____ MILES" with the W20-5 signs located _____ miles (kilometers) from the beginning of the lane taper. Spacing of the other signs shall be as shown on SCD MT 95.40.

(Optional paragraph - The contractor shall have a third Extra Advance Warning Sign Group (6 signs and 2 distance plates) available for use when directed by the Engineer. The distance plates for this group shall read "_____ MILES.")

Payment for providing, erecting, maintaining and removing Extra Advance Warning Sign Groups shall be included in the lump sum bid for Item 614, Maintaining Traffic.

Designer Note: As noted in ***Section 641-5.2***, this note should be used to require extra Advance Warning Sign Groups in situations involving work that will extend over a holiday or any other anticipated period of unusually high traffic demand, if the queue resulting from a lane closure on a multilane divided highway is expected to extend beyond the normal ROAD WORK AHEAD sign. See ***Section 641-5.2*** for further information.

642-35 Item 614, Work Zone Crossover Lighting System

This work shall consist of furnishing, erecting, operating, maintaining and removing a work zone lighting system for a single crossover, or overlapping a pair of crossovers on a two-lane, two-way operation. The system shall be as shown on SCD MT-100.00. The Contractor shall arrange for and pay for power. All materials and construction shall comply with applicable portions of 625 and 725 except: The Performance test of 625.19F, and certified drawing requirement of 625.04, are waived and used materials in good condition are acceptable.

Poles may be less than 30 ft (9 m) from the edge of pavement when behind guardrail. Additional pole lines, cables and appurtenances necessary to furnish power to the lighting system shall be included in this item. Service poles shall be positioned with the same constraints as the lighting poles as a minimum.

Payment will be made at the unit price per each for Item 614, Work Zone Crossover Lighting System throughout all phases of work when the crossover roadways are used.

Designer Note: As noted in ***Section 641-9.5***, this note should be included in the plan when a work zone crossover lighting system is provided.

642-36 Multi-Plan, Time-of-Day Operation of Work Zone Signal

The work zone signal control required for this project and shown on sheets _____ and SCDs MT-96.10 or 96.11, 96.21, and 96.25 or 96.26 shall be capable of providing multiple timing patterns chosen on a time-of-day basis.

Traffic control equipment shall be capable of time-of-day/day-of-week programming; with a minimum of three-dial, three offsets and three splits, or a minimum of fifteen separate timing plans.

	Timing Plan (Seconds)		
	A	**B**	**C**
Northbound Green	31*	41	16*
Northbound Yellow	3.5	3.5	3.5
Northbound All Red (Internal Clearance)	18	18	18
Southbound Green	30	20	15
Southbound Yellow	3.5	3.5	3.5
Southbound All Red (Internal Clearance)	19	19	19
Total Cycle Length	105.0*	105.0	75.0*

* Provide Timing Appropriate for the Signal Location Under Consideration

Time of Day	SUN	MON	TUE	WED	THUR	FRI	SAT
Midnight - 7:00 a.m.	C*	C	C	C	C	C	C*
7:00 a.m. - 9:00 a.m.	C	A	A	A	A	A	C
9:00 a.m. - 4:00 p.m.	A	C	C	C	C	C	A
4:00 p.m. - 6:00 p.m.	C	B	B	B	B	B	A
6:00 p.m. - Midnight	C*	C	C	C	C	C	C*

Payment is incidental to the lump sum bid for Item 614, Maintaining Traffic.

Designer Note: This note should be included in the plan when a signalized one-lane, two-way closing is used.

642-37 Fully-Actuated Operation of Work Zone Traffic Signal

The work zone signal control required for this project and shown on sheets _____ and SCDs MT-96.10 or 96.11, 96.21 and 96.26 shall be fully traffic-actuated and operate in a manner similar to that described in Section 733.02 of the Construction and Material Specifications.

The initial controller timing shall be as follows:

	Phase *			
	1	2	3	4
Initial	7 +/-	10	8	10+/-
Vehicle	4	3	4	3
Maximum	11	30	12	30
Yellow	3	3.5	3	3.5
All Red	2	2	2	2
Recall	ON+/-	OFF	ON	OFF+/-

*Phases as shown on SCD MT-96.26 for Actuated Control
+/- Provide timing for the signal location under consideration.

The Contractor shall also design, furnish, install and maintain a traffic detector on each traffic approach which will reliably detect all legal traffic approaching (but not leaving) the signal as it passes or waits in the designated detector zone shown in the plans. Detector designs which do not provide reliable detection, free from false calls, shall be immediately replaced by the Contractor.

Designer Note: This note should be included in the plan when a signalized one-lane, two-way closing is used.

642-38 Overhead-Mounted Work Zone Signals

Signals shall be overhead mounted in accordance with the details shown on SCD MT-96.21.

Designer Note: This note shall be used when overhead-mounted signals are used.

642-39 Item 614, Work Zone Lighting System (for Shoulder Transition)

This work shall consist of furnishing, erecting, operating, maintaining and removing a work zone lighting system for an area involving use of the shoulder for through traffic, as well as the areas leading into and out of this section. The system shall be as shown on SCD MT-102.10 (MT-102.20). The Contractor shall arrange for and pay for power and any costs of providing service. All materials and construction shall comply with applicable portions of CMS 625 and 725 except: The Performance Test of CMS 625.19F, and certified drawing requirement of CMS 625.04 are waived and used materials in good condition are acceptable. A photocell shall turn on the lighting when ambient light is below 3 foot candles. All overhead wiring shall be #4 AWG minimum. Down guy anchors shall be provided at both ends of overhead spans. All wires crossing the roadway shall have a minimum height of 20 feet (6.1 m).

Payment will be made at the unit price per each Item 614, Work Zone Lighting System which will include erection, operation, maintenance, removal and power for all lighting required by SCD MT-102.10 (MT-102.20).

Designer Note: As noted in ***Section 641-19***, this note should be used when existing lighting is not available and a transition plan which uses the shoulder to maintain traffic will be in use for more than fourteen days. In this situation a work zone lighting system shall be used for the tapers; however, continuous lighting of the work area between the lighted tapers is only required when the tapers are provided with work zone lighting and the distance between lighted tapers is less than 2000 feet (610 meters).

642-40 Maintenance of Canoe Traffic

Canoe traffic shall be maintained throughout construction of the project either through existing river channel or through portage trail approved by the Engineer.

Adequate signing both upstream and downstream shall be installed and maintained by the contractor. The following type signs are considered to be minimum treatment.

1. Approximately 1/4 mile (0.6 kilometer) upstream, advanced warning type signs on both banks

2. Approximately 300 feet (90 meters) upstream, signs specifying actions required of canoeist on both banks

3. Approximately 1/4 (0.6 kilometer) mile downstream, advance warning type signs on both banks

4. Approximately 300 feet (90 meters) downstream, signs specifying actions required of canoeist of both banks

The above signing shall be mounted in such a way as to be a minimum of 4 feet (1.2 meters) above the water level, unobstructed by tree branches, and properly angled for maximum visibility from the main clear channel. The method of supporting the signs shall be approved by the engineer prior to installation. Upon completion of the project, the signs and support systems shall be completely removed from the river channel. The contractor shall notify local canoe liveries using this portion of the river at least 10 days prior to any changes affecting canoe traffic.

Portage trails if used shall be constructed and maintained by the Contractor with the least possible disturbance to the surrounding area. The trail shall be adequately marked in both directions. The contractor shall be responsible for obtaining the right-of-way for the portage trails if required.

In the event pipes are used to divert or carry river water, both the inlet and outlet ends shall be

adequately protected by grates or fence so that people or canoes are not drawn through or held by them.

642-41 Item 614, Portable Changeable Message Signs, As Per Plan

The Contractor shall furnish, install, maintain and remove, when no longer needed, a changeable message sign, on site, for the duration of the project. The sign shall be of a type shown on a list of approved PCMS units maintained by the Director (Office of Materials Management). This list is available on the ODOT website at http://www.dot.state.oh.us/testlab/applists/misc/pcms.htm. The list currently contains Class I, II, and III units with minimum legibility distances of 1250 ft., 850 ft. and 650 ft., respectively.

Each sign shall be trailer-mounted and equipped with a functional dimming mechanism, to dim the sign during darkness, and a tamper and vandal proof enclosure. Each sign shall be provided with appropriate training and operation instructions to enable on-site personnel to operate and troubleshoot the unit. The sign shall also be capable of being powered by an electrical service drop from a local utility company. PCMS trailers should be delineated on a permanent basis by affixing retroreflective material, in a continuous line on the face of the trailer as seen by oncoming road users.

The probable PCMS locations and work limits for those locations are shown on sheet(s) ____ of the plan. Placement, operation, maintenance and all activation of the signs by the Contractor shall be as directed by the Engineer. The PCMS shall be located in a highly visible position yet protected from traffic. The Contractor shall, at the direction of the Engineer, relocate the PCMS to improve visibility or accommodate changed conditions. When not in use, the PCMS shall be turned off. Additionally, when not in use for extended periods of time, the PCMS shall be turned, facing away from all traffic, and shall display one or more high-intensity yellow reflective sheeting surfaces of 9-inch by 15-inch minimum size facing traffic.

The Engineer shall be provided access to each sign unit and shall be provided with appropriate training and operation instructions to enable ODOT personnel to operate and troubleshoot the unit, and to revise sign messages, if necessary.

(The Contractor shall implement a system whereby changeable messages will be implemented within _____ hours following telephone notification from the Project Engineer to a designated phone.)

All messages to be displayed on the sign will be provided by the Engineer. A list of all required pre-programmed messages will be given to the Contractor at the project preconstruction conference. The sign shall have the capability to store up to 99 messages. Message memory or pre-programmed displays shall not be lost as a result of power failures to the on-board computer. The sign legend shall be capable of being changed in the field. Three-line presentation formats with up to six message phases shall be supported. PCMS format shall permit the complete message for each phase to be read at least once.

The PCMS shall contain an accurate clock and programming logic which will allow the sign to be activated, deactivated or messages changed automatically at different times of the day for different days of the week.

(The PCMS shall contain a cellular telephone data link which will (in active cellular phone areas) allow remote sign activation, message changes, message additions and revisions to time of day programs. The system shall also permit verification of current and programmed messages. One remote data input device (laptop computer plus modem or equivalent) shall be furnished for use by the District Traffic Engineer, or equivalent, and shall be insured against theft.)

The PCMS unit shall be maintained in good working order by the Contractor in accordance with the provisions of CMS 614.07. The Contractor shall, prior to activating the unit, make arrangements, with an authorized service agent for the PCMS, to assure prompt service in the event of failure. Any failure shall not result in the sign being out of service for more than 12 hours, including weekends. Failure to comply may result in an order to stop work and open all traffic lanes and/or in the Department taking appropriate action to safely control traffic. The entire cost to control traffic, accrued by the Department due to the Contractor's noncompliance, will be deducted from moneys due, or to become due the Contractor on his contract.

The Contractor shall be responsible for 24-hour-per-day operation and maintenance of these signs on the project for the duration of the phases when the plan requires their use.

Payment for the above described item shall be at the contract unit price. Payment shall include all labor, materials, equipment, fuels, lubricating oils, software, hardware and incidentals to perform the above described work.

Item 614, Portable Changeable Message Sign, as per plan _____ Sign-Month

Designer Note: Portable changeable message signs (PCMSs) are trailer-mounted programmable message units which can be utilized to provide advance information about upcoming traffic conditions or diversion routing schemes to road users ***(see Section 605-9)***. PCMS units are supplemental information devices and shall not be utilized as alternates to standard fixed signing or flashing arrow panels.

On major construction projects, PCMS units, although costly ($1,000 to $2,500 per sign-month), can provide real benefits to road users. These benefits include increased work zone capacity resulting from advance warning of lane closures, and improved corridor capacity resulting from diversion schemes implemented in reduced capacity situations.

PCMSs are intended to have a high impact on the motorist and to convey timely, pertinent, driver oriented information which could not be provided by fixed-message signs. For this reason, if no important message needs to be displayed, the sign shall be turned off. The display of non-priority messages is discouraged as drivers tend to become familiar with these and overlook priority messages displayed later.

The use of PCMS should be reserved for situations where signs must be changed frequently and/or where the next required message cannot be predicted in advance. When a message is known in advance or when it could be determined before there is a need to display it, then a fixed-message sign is appropriate. Certainly, messages such as LEFT/RIGHT LANE CLOSED AHEAD should not be considered for PCMS display because there are standard signs readily available for this purpose and emphasis can be added with flashers or flags at a nominal cost. Similarly, non-standard messages such as ROAD WORK WILL CLOSE TWO (2) LANES BEGINNING MARCH 25, 2003 can normally be determined well in advance of need and included in the plans as fixed-message signs. Even where sign messages must change periodically, a fixed-message sign with flip-up panel may be more appropriate.

Sign messages shall be limited to a maximum of two sequential displays or phases, each consisting of a maximum of three, eight-character lines. The pre-qualified list of PCMS is provided on the ODOT website at http://www.dot.state.oh.us/testlab/applists/misc/pcms.htm. This list contains the PCMS approved for use on ODOT projects. The pre-qualified list currently contains three classes of PCMS. The Class I unit is an ideal design providing a minimum of 1250 feet of legibility distance, or 13 seconds of legibility at 65 miles per hour. The Class II unit provides a minimum of 850 feet of legibility distance, or 8.9 seconds of legibility at 65 miles per hour. The Class III unit, which is the original basic design, provides a minimum of 650 feet of legibility distance, or 8 seconds of legibility at 55 miles per hour. Eventually the Class III units will be dropped from most

projects in favor of the more legible Class II and above units. The pre-qualified list is maintained by the **Director (Office of Materials Management)**.

When specifying the number of sign-months required, care should be exercised to require that the contractor furnish a specific number of units on site, for the duration of each phase, or for the duration of the entire project if appropriate, rather than merely having "X" units available. If standby units are needed, they shall be so specified along with a time interval in which a malfunctioning unit must be replace.

The fifth paragraph in this Plan Note is optional. This paragraph is to be included in the plans when it is intended that time-of-day/day-of-week programming capability is to be provided. This feature allows for certain messages to be pre-selected for anticipated critical times, and also allows the unit to be automatically turned off when there is no significant message to convey.

The eighth paragraph in this Plan Note is also optional. This paragraph is to be used when it is necessary to require cellular phone data link programming of PCMS operation and messages. This should be included only when potential maintenance of traffic problems justify its use; and only when procedures have been developed to assess travel problems on a current basis and an operating agency (e.g., **District Traffic Department**, **City Traffic Department**, **OSHP** or **City Police Department**) is prepared to monitor and operate the system on a real-time basis with current information. Further, the cellular phone option should not be invoked unless the designer has assured that cellular phone services are available in the proposed sign area. Generally, PCMS units should be located well in advance of the situation to which they relate. In the case of diversion schemes, the PCMS units should be located well in advance of the upstream interchange where the alternate route begins. The desired location(s) for deployment of PCMS units shall be established by means of a Plan Note listing the specific locations where the contractor is to install, maintain and remove the PCMS units(s) and the duration the PCMS unit is to function. Designers should field review potential sites to find those with good visibility and a level, accessible area, preferably behind existing guardrail. The Plan Note also permits the project engineer to relocate the sign to improve visibility or to accommodate changing conditions.

642-42 Maintenance of Traffic Signal/Flasher Installation

The Contractor shall be responsible for maintaining traffic signal/flasher installations within the project under the following conditions:

1. Existing signal/flasher installations which the plans require the Contractor to adjust, modify, add onto or remove, or which the Contractor actually adjusts, modifies or otherwise disturbs. The Contractor shall be responsible for the entire installation (at an intersection) from the time his operations first disturb the installation until the installation has been subsequently removed or modified and the work is accepted.

2. New or reused signal/flasher installations or devices, installed by the Contractor. The Contractor shall be responsible for maintenance of these from the time of installation until the work is accepted.

The Contractor shall correct as quickly as possible all outages or malfunctions. He shall provide the maintaining agency and the Engineer such addresses and phone numbers where his maintenance forces can be contacted. The Contractor shall provide one or more persons to receive all calls and dispatch the necessary maintenance forces to correct outages. Such a person or persons may be used to perform other duties as long as prompt attention is given to these calls and a person is readily available continuously 24 hours a day, 7 days a week. All lamp outages, cable outages, electrical failures, equipment malfunctions and misaligned signal heads shall be corrected to the satisfaction of the Engineer with the signal back to service within four hours after the Contractor has been notified of the outage.

In the event new signals are damaged prior to acceptance, all damaged equipment except poles and control equipment shall be replaced by the Contractor to the satisfaction of the Engineer with the signal back in service within 8 hours after the Contractor's notification of the outage. The Contractor shall arrange for full traffic control until the signal is back in operation.

If poles and/or control equipment are damaged and must be replaced, the Contractor shall make temporary repairs as necessary to bring the signal back into full operation within the allowed 8-hour period, and shall make permanent repairs or replacement as soon thereafter as possible.

None of the above shall be construed as collective or consecutive outage time periods at any one location. That is where more than one outage occurs at any one location, then the allotted time limit shall be for the worst single outage.

Where outages are the direct result of a vehicle accident the response of the Contractor shall be as outlined above. The Contractor shall be responsible for collection of any compensation for this work from those parties responsible for the damage.

Where the Contractor has failed to, or cannot respond to, an outage or signal equipment malfunction, at these locations within his responsibility, within periods as specified above, the Engineer may invoke the provisions of Section 105.15 and any subsequent billings to the State or the City of _____ for Police Services and maintenance services by City forces shall be deducted from monies due or to become due the contractor in accordance with provisions of Section 105.15.

The Contractor shall provide the maintenance service entirely with his forces or he may choose to enter into a cooperative understanding with the local maintaining agency to provide the maintenance. The Contractor shall inform the Engineer, in writing, of the maintenance method selected.

The Contractor shall be responsible for any damage to any traffic signal components required to be handled during the relocation of poles and revisions to the signal system.

When a traffic signal must be taken out of service by the Contractor, due to construction procedures, this outage shall not exceed ___ hours and shall not include the hours of ___ to ___. Any signalized intersection, where the signal is out of service due to construction procedures, or due to an outage or malfunction of equipment as described above, shall be protected, by the Contractor, by the installation of temporary "STOP" signs, except for the following intersections which shall be protected by off-duty City of _____ Police, hired by the Contractor:

1.

2.

3.

Any vehicular traffic signal head, either new or existing which will be out of operation shall be covered in the manner described in 632.24.

The contractor shall maintain complete records of malfunctions including:
1. Time of notification of malfunction;
2. Time of work crews arrival to correct the malfunction;
3. Actions taken to correct the malfunction, including a list of parts repaired or replaced;
4. A diagnosis of reason for the malfunction and probability of reoccurrence;
5. Time of completion of the repair and system restored to full service.

A copy of these records shall be provided to the Engineer within three (3) working days following completion of each repair.

All costs resulting from the above requirements shall be considered to be included in the lump sum price bid for Item 614, Maintaining Traffic.

Designer Note: This note may be used when existing signals are to be maintained.

642-43 Advance Work Zone Information

Advance work zone information signs, as used in this note, are fixed message types. The signs are to be located at extreme distance from the work area, as shown in the plans.

The signs shall be black on orange (including a black border). The layout shall be in conformance with TEM Section 211.

When regulatory information is provided, it shall be displayed separately as a standard black-on-white sign. Mixing of black-on white regulatory information on a black-on-orange information sign is prohibited.

If the motorist is being detoured or if an alternate route is provided, the route should be signed with assemblies consisting of the appropriate black-on-orange DETOUR or ALT marker with a standard route marker and arrow plate. If more target value is desired, this trail blazer information may be shown on an orange panel (OMUTCD Section 2D.32).

Route marker assemblies shall be sized according to the type of road on which they are located in accordance with the OMUTCD.

Supports for sign installations shall conform to all existing standards for permanent signs. These signs should not be attached to existing supports.

Where the plans call for an overlay to cover a portion of an existing sign, the overlay shall be black-on-orange. Letter sizes should be the same as on the existing signs. When lane arrows are to be covered, rather than using a blank overlay, the legend “LANE CLOSED” shall be used. When a ramp is being closed, rather than using a blank overlay to cover the entire sign, the legend “CLOSED” shall be used on a diagonal overlay (lower left to upper right) on the sign. The size of lettering on overlays and the size of the overlay are indicated in the plans. The minimum letter size for “LANE CLOSED” shall be 10" E. The minimum letter size for the diagonal “CLOSED” overlay shall be 12" E.

All advance work zone information sign installations located outside of the project work limits shall be paid for under appropriate 630 items (signs, supports, concrete, breakaway connection, overlays, removals, etc.).

Designer Note: This note may be used when it is necessary to provide advance information on fix signs, as discussed in ***Section 640-26***.

642-44 Worksite Traffic Supervisor

The contractor shall employ (other than the superintendent) and subject to the approval of the Engineer, a certified Worksite Traffic Supervisor (WTS). The WTS may be certified from one of the following organizations:

1. American Traffic Safety Service Association (ATSSA), phone number 1-800-272-8772, certified Worksite Traffic Supervisor (WTS)

2. The National Safety Council, Traffic Control Zones Supervisors course, phone number 1-800-441-5103

3. National Highway Institute, Design and Operation of Work Zone traffic Control, phone number 1-703-235-0528

The WTS position is established for the purpose of monitoring and correcting any traffic control deficiencies in the work zone. The WTS must also coordinate with ALL law enforcing agencies responsible for the roadway under construction and retrieve all crash reports (OH-1) that occur during the construction season. The WTS shall oversee all operations that affect the movement of vehicular and pedestrian traffic through the work zone. Traffic control and crash data evaluation will be the WTS main duty while the work zone is in place.

The WTS shall be present when the contractor or subcontractor installs a traffic restriction, lane closure, etc. In lieu of the WTS being present when a subcontractor has a work zone in place, the contractor may use his own personnel that is a certified WTS. The contractor or subcontractor must present a copy of his WTS certificate to the project engineer. A WTS must be present when the work zone is being set up.

Daily, including weekends and holidays, the WTS shall spend a minimum of one hour reviewing the work zone and/or crash data for deficiencies and maintaining the work zone. The WTS must retrieve/collect ALL crash reports (OH-1) from ALL law enforcing agencies, evaluate the crashes, and recommend solutions to address any issues that are potentially creating crashes within the work zone. The WTS must present his/her solutions to the Engineer and the District Work Zone Traffic Manager (DWZTM) for approval at all project progress meetings. Upon approval by the Engineer and the DWZTM, the contractor must be implement the recommended solutions to the work zones within one week. These hours may adjusted by the Engineer but must be performed once a day during the construction seasons. The WTS must inspect the work zone at the beginning and the end of each work day and one time per week during the hours of darkness.

A record of each days review shall be given to the project engineer the following work day. Also in writing the WTS report shall include: traffic control device condition, placement, visibility, traffic flow conditions, incidents, accidents, congestion points, adequacy of advanced warning signs beyond project limits, interaction of work vehicles and traffic, proper storage of materials and equipment.

If the restrictions are short term, the WTS shall monitor the zone for compliance. During the lane closure he shall make sure all traffic control items are functioning properly. Traffic control and crash data evaluation will be the WTS main duty during implementation of zones or short term zones. The WTS shall have the authority to have deficiencies corrected as soon as possible. The WTS shall provide the district work zone traffic control engineer a sketch of the traffic control plan (TCP) every day there is to be a short term traffic restriction, lane closure, etc. This TCP shall show how the work zones are to be implemented.

The WTS shall be available on a 24-hour basis to repair and/or replace damaged or missing traffic control devices. A 24-hour phone number shall be made available to the project engineer in order to contact the WTS. The WTS shall have a pager and the phone number provided to the project engineer.

Failure of the contractor to comply with any of the above, shall constitute cause for the project engineer to deduct $500.00 per day from money due to the contractor, not as a penalty, but as a liquidation damage.

Payment for the WTS shall be included under the lump sum price for Item 614 - Maintaining

Traffic.

Designer Note: The Worksite Traffic Supervisor note is intended for use on long-term projects located on multi-lane facilities.

642-45 Item 614 - Maintaining Traffic

The contractor shall be responsible for designing and maintaining safe and effective traffic control 24 hours a day for the duration of this project. All traffic control devices shall be furnished, erected, maintained, and removed by the contractor.

The contractor shall devise a maintenance of traffic scheme which shall be stamped by a professional engineer, and present it to the engineer for approval. The maintenance of traffic scheme shall present, in general, the method for conducting the required work in a safe and efficient manner.

The plans shall include the following components:

- Plan view at an appropriate scale to show:
  - Work area
  - Begin/end stationing of tapers, temporary markings, etc.
  - Temporary Pavement
  - Locations of signs (existing overhead signs and all proposed, covered, or modified signs)
  - Locations of typical sections
  - References to applicable standard drawings
- Typical sections showing:
  - Lane widths, pavement markings, drums, PCB, etc.
  - Limiting stations
  - Work area and drop-offs
- Sign details for proposed signs and overlays/modifications

The Maintenance of traffic scheme shall be in conformance with the Ohio Manual of Uniform Traffic Control Devices, latest revision, the referenced standard construction drawings including designer notes, the construction and material specifications (CMS), Policy No. 516-003(P) Traffic Management in Work Zones Interstate and Other Freeways, ODOT Location and Design Manual, Volume 1, and all requirements detailed in these plans.

This submittal shall consist of three (3) copies of the plans for review and distribution. No work shall begin at the location until the maintenance of traffic plans have been approved by Ohio Department of Transportation.

The progress schedule will be required to approve the maintenance of traffic plans. This schedule of operations shall detail the contractor's work activities and his methods of maintaining traffic during these activities. Maintenance of traffic plans shall be prepared and submitted to the district for approval. These plans shall be sealed by a registered professional engineer. The District shall have 14 calendar days to review and comment on these plans. The contractor shall not begin any work requiring traffic control until the engineer has given approval of the contractor's sequence of operations and maintenance of traffic plans.

The maintenance of traffic scheme shall take into consideration snow and ice operations from December 1 through March 31. Lane shifts, restrictions, and closures may not be approved if they adversely affect snow removal operations.

If in the opinion of the engineer, the contractor fails to comply with these requirements and the provisions of the approved maintenance of traffic plan, the engineer shall suspend work until all requirements are met. Any costs or delays incurred as a result of the failure shall be the full

responsibility of the contractor.

Payment for all the items required to maintain traffic in accordance with these requirements shall be included in the lump sum price for Item 614 - Maintaining Traffic, as per plan.

Designer Note: This note is intended for use with plans calling for contractor-developed maintenance of traffic plans.

642-46 Item 614 - Transition Area Delineation

In transition areas for lane shifts equal to or greater than 4 feet (1.2 m) and crossovers, the Contractor shall provide delineation by one of the following methods:

1. Full pavement markings using 873 Wet Reflective Removable Tape (Method A on MT-99.30 and MT-99.31); or

2. Full pavement markings using 740.06 Type I work zone pavement marking material supplemented with work zone raised pavement markers (Method B on MT-99.30 and 99.31).

All material furnished shall be listed on the Department's Prequalified Lists. The installation of all materials shall meet or exceed the manufacturers' recommendations.

After removable pavement markings have been installed, they shall be cut at 10 foot (3.0 meter) or shorter intervals.

Payment for Item 614 Transition Area Delineation shall be made at the contract bid price per foot (meter) of Transition Area and shall include the cost of furnishing, installing, maintaining and removing, if necessary, one of the delineation schemes specified above.

Payment shall also include replacement, as per 614.11.A (Construction and Materials Specifications) or 614.115.D (Proposal Note 101-2002), of any part of the delineation system which, in the judgment of the Engineer, fails. Lane closures required to repair or replace missing tape or work zone raised pavement markers will be at the Engineer's approval and at the Contractor's cost.

The transition area for shift tapers is generally considered to begin 300 ft (90 m) in advance of the beginning of the shift taper and to end 300 ft (90 m) beyond the termination of the shift taper. The transition area for crossovers is generally considered to begin 300 ft (90 m) in advance of the beginning of the crossover geometrics and to end 300 ft (90 m) beyond the termination of the crossover geometrics.

Designer Note: This note shall be included on all projects which have either a lane shift of 4 feet (1.2 m) or more, or a crossover as part of the maintenance of traffic scheme.

It is intended that the contractor be given the option to provide delineation using either Method A or Method B. This note may be revised to require use of Method B; however, the note shall not be revised to require Method A.

The transition area is generally considered to begin 300 ft (90 m) in advance of the beginning of the shift taper or crossover and to end 300 ft (90 m) beyond the termination of the shift taper or crossover. If it is necessary to revise the lengths of these approach distances, the plan note shall be revised accordingly. If the approach distances vary among the several approach distances within the plans, the limits of each transition area within the plans shall be specified individually.

643 SPECIFICATIONS

ODOT specifications discussed in this chapter for furnishing and installing temporary traffic control devices and material for work zones are contained in the following **CMS** sections:

108 Prosecution and Progress
410 Traffic Compacted Surface
614 Maintaining Traffic
615 Roads and Pavements for Maintaining Traffic
622 Concrete Barrier
641 Pavement Marking - General

630 and 730 Traffic Sign and Support Material
631 and 731 Sign Lighting and Electrical Signs

650 CONSTRUCTION

650-1 General

This section is intended to provide additional information on temporary traffic control that would be helpful particularly to construction personnel. However, it may also be useful for maintenance personnel performing the same functions. Inspection procedures for temporary traffic control devices will be addressed in this section. Inspection procedures for other types of traffic control devices are outlined in the other chapters related to the various types of traffic control devices.

650-2 Removal of Logo Signs

Logo signs (which include establishments for Gas, Food, Lodging, Camping and Attractions) are the property of **Ohio Logos, Inc.** and are not to be removed or replaced by **ODOT** staff or by contractors working for **ODOT**. The contractor shall notify **Ohio Logos** (toll-free 1-800-860-LOGO) at least sixty days prior to the date of desired removal.

650-3 Quality Standards for Sheeting

The **ATSSA** publication **Quality Standards for Work Zone Traffic Control Devices** ***(Section 695-4)*** shall be used to determine the acceptability of reflectivity conditions for work zone traffic control devices.

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660 MAINTENANCE / OPERATIONS

660-1 General

The consequence of poor maintenance practices are a reduction in safety to road users and an unnecessarily large exposure to liability claims. **District Roadway Services** personnel are responsible for establishing and maintaining temporary traffic control zones for District maintenance work and force account operations projects. Additional information is provided separately in the other chapters regarding maintenance activities related to signing, markings, traffic signals and lighting.

660-2 Work Zone Set-up Reviews (OPIs and QARs)

ODOT has developed a program to review maintenance of traffic set-up in temporary traffic control zones. The program has basically two parts, the Operation Performance Index (OPI) and the Quality Assurance Review (QAR).

The OPI applies to work zones on Interstate and Interstate look-alike highways. Representatives from the **Office of Traffic Engineering** will travel the Interstate highway system twice per construction season to evaluate temporary traffic control zone set-ups throughout the State. A representative from the District being evaluated, as well as a representative from FHWA, will be welcome to come along for the field review. It is expected that each District review will require ½ to 1 full day time period. Work zone set-ups along Interstate look-alikes will also be evaluated at that time. It will be the responsibility of the **District** to correct any inadequacies reported regarding set-ups in temporary traffic control zones and to determine the cause of the inadequacies, e.g., contractor, designer or management error. Items subject to review include:

1. Fixed signs, condition and usage;
2. Channelizing devices.
3. Portable concrete barrier and unprotected hazards;
4. Portable changeable message signs and arrow panels;
5. Pavement marking;
6. Tapers; and
7. Entrance and exit ramps.

The QAR applies to work on all highways on the state highway system, other than those covered in the OPI, including two-lane and multi-lane controlled or uncontrolled access. These reviews apply to both contract work and to maintenance work. Sites to be reviewed will be chosen at random. The field trips will include personnel from the **Office of Traffic Engineering** and personnel from other **Districts**. Items subject to review will be the same as with the OPI evaluations. If inadequacies persist, the QAR review team will review the situation in further detail to determine the cause of the inadequacies and to recommend solutions.

660-3 Removal of Logo Signs

Logo signs (which include establishments for Gas, Food, Lodging, Camping and Attractions) are the property of **Ohio Logos, Inc.** and are not to be removed or replaced by **ODOT** staff or by contractors working for **ODOT**. If maintenance work necessitates removal of the LOGO sign, **Ohio Logos** must be given reasonable time to remove the sign (toll-free 1-800-860-LOGO). Failure by **Ohio Logos** to respond in reasonable time may necessitate removal by **ODOT** staff.

670 OTHER CONSIDERATIONS

670-1 General

This section has been reserved for information on other considerations that should be noted, but for various reasons have not been addressed in the other sections of the chapter. For example, it may at times be used to expedite incorporating information that will later be consolidated into other sections.

670-2 Bikeways

As noted in ***Section 606-11***, if the temporary traffic control zone affects the movement of bicyclists, adequate access to the roadway, bicycle paths, or shared-use paths shall be provided. Additional information on bikeways may be found in **OMUTCD Part 9**, ***Part 9 of this Manual***, and the **Guide to the Development of A Bicycle Facility**.

670-3 Waterways

On projects involving construction or major reconstruction of structures over navigable waterways, provisions should be made to inform and/or guide watercraft traffic through the construction area.

Projects that close rivers or streams for construction purposes should provide a safe portage for light watercraft along with appropriate Guide and Warning Signs in each direction.

Projects that do not close rivers or streams, but alter existing portages or create otherwise hazardous conditions for watercraft passage, should provide adequate Guide and Warning Signs and protection, where appropriate, along the waterway.

Additional information on watercraft traffic and navigable waters can be obtained through the **Ohio Department of Natural Resources, Division of Watercraft.**

670-4 Motorcycles

Motorcycles are more susceptible to variations or obstacles in the road surface than are other vehicles. If a potential hazard cannot be eliminated, it is vital that motorcyclists receive a warning of the hazard well in advance. Warning Signs should be considered for potential hazards, especially for pavements that are heavily grooved or contain rumble strips, loose gravel or pavement edge drop offs.

670-5 Towing Operations

Towing operations shall be performed in a safe manner. Short-duration towing operations shall follow the guidelines applicable to short-duration maintenance operations ***(see Section 606-3.5)***.

All towing vehicles shall display a flashing, rotating or oscillating amber light visible to all directions of traffic for at least one-quarter mile (0.4 kilometer), regardless of any other devices that may be mounted on the vehicles.

670-6 Rest Areas

670-6.1 General

When rest areas exist within a temporary traffic control zone, a decision must be made at an early stage as to whether the rest area will remain open or whether it will be closed during the work. Rest area closures will simplify the traffic control plan.

When rest areas remain open during construction, traffic control at the rest area entrance and exit ramps should be implemented as shown in **MT-98 series of SCDs**.

670-6.2 Rest Area Closures

Rest areas shall not be closed to the public without approval of the **District Deputy Director**. Approvals of temporary rest area closures called for within construction projects become effective with the **District Deputy Director's** signature on the title sheet.

All advance Rest Area signs (D5-1, D5-2, D5-H2a, D5-H6) shall have the action message covered by an overlay bearing the legend "CLOSED." This panel shall have a black legend on a reflectorized orange background. The overlay for the D5-1 and D5-H2a signs shall be 8 x 1.5 feet (2.4 x 0.15 meters). The overlay for the D5-2 and D5-H6 signs shall be 4 x 1.5 feet (1.2 x 0.46 meters). Supplemental panels (TELEPHONE, TOURIST INFO., Handicapped symbol, etc.) located under mainline Rest Area signs shall be removed or covered when the rest area is closed. On conventional highways, the overlay panel size shall be 28 x 10 inches (700 x 250 mm).

Distance information provided on the NEXT REST AREA XX MILES sign (D5-H7), located in advance of the upstream rest area, shall be modified to provide the distance to the next open downstream rest area. This modification shall be accomplished by providing a black on orange overlay to cover the distance provided on the sign.

As shown in **SCD MT-98.19**, the entrance ramp to the rest area shall be closed by use of drums, as per **CMS 614.03**. The exit ramp from the rest area shall be closed in a similar manner. On major standard highways where a median opening may exist to permit access to and from the rest area, this opening shall also be closed in a similar manner.

Where rest area lighting exists, it shall be maintained in proper condition to provide optimum illumination.

670-6.3 Restroom Closures

Rest areas shall not be closed because of restroom failure. If restrooms are closed because of mechanical failure or any other reason except routine maintenance, the REST ROOMS CLOSED sign (D5-H33), black legend on reflectorized orange background, shall be used to inform the road user of the closure. On freeways and expressways the D5-H33, 48 x 48 inches (1.2 x 1.2 meters) sign shall be installed below the Advance Rest Area sign (D5-1), and may be installed below the (D5-2) and D5-H2a signs; however, it shall not be installed at the D5-H6 gore sign. On conventional highways, the D5-H33-24 sign, 24 x 24 inches (0.6 x 0.6 meters), shall be installed below the Advance Rest Area sign (D5-H1) and may be installed below the D5-H2 sign.

670-7 Railroad Crossings

An important design consideration in the development of temporary traffic control plans involving railroad grade crossings is the potential for vehicles queuing onto the railroad tracks. Adjusting the transition area and/or buffer space might be appropriate so that downstream congestion caused by a lane drop, for example, does not reach the railroad crossing.

When the grade crossing is equipped with an active traffic control system, the normal sequence of highway intersection signal indications should be preempted upon approach of trains to avoid entrapment of vehicles on the crossing by conflicting aspects of the highway traffic signals and the grade crossing signals. Temporary traffic control signals near grade crossings should be operated so that vehicles are not required to stop on the tracks. See **OMUTCD Part 8** and ***Part 8*** of this Manual for additional information.

Guidance on traffic control near railroad crossings is provided in **OMUTCD Part 8, Section 6G.18 and Figure 6H-46** and ***TEM Section 606-19 and Part 8***.

670-8 Transit Considerations

Provision for effective continuity of transit service needs to be incorporated into the temporary traffic control planning process. Oftentimes, public transit buses cannot efficiently be detoured in the same manner as other vehicles (particularly for short-term maintenance projects). On transit routes, the traffic control plan ***(Section 602-2)*** should provide for features such as temporary bus stops, pull-outs and waiting areas for transit patrons.

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695 REFERENCE RESOURCES

695-1 General

Various reference resources that may be useful have been noted in ***Sections 193, 194 and 195.***

695-2 Temporary Traffic Control Manual (reprint of OMUTCD Parts 1, 5 and 6)

OMUTCD Parts 1, 5 and 6 have been reprinted as a separate document for use in the field. The book is titled the Temporary Traffic Control Manual; however, it is also known as the Construction Manual or the Orange book, since it has an orange cover.

695-3 Flagger Handbook

As noted in ***Section 614-5***, the **Flagger Handbook** published by **ATSSA** is a pocket-size booklet, intended for use by field staff for easy reference to proper flagging procedures.

695-4 Quality Standards for Work Zone Traffic Control Devices

Published by **ATSSA**, this document sets standards for acceptability of conditions of temporary traffic control devices. It is intended to provide uniformity in condition of traffic control devices on the public highway system. These standards are intended to address the day-to-day needs of traffic control within a work zone and are not meant to cover needs of emergency situations.

695-5 Guidelines for the Use of Portable Changeable Message Signs

The **ATSSA** publication, **Guidelines For The Use of Portable Changeable Message Signs**, is recommended as guidance for use in determining how to make use of PCMSs to inform motorists of traffic conditions due to construction activity.

695-6 Project Communication Manual

As noted in ***Section 600-5***, the **Project Communication Manual** was developed by the **Office of Communications** to give guidance in developing a communication plan for a specific project in order to insure adequate communication with all interested parties at all stages of development. It is attached to **Policy No. 516-003(P)** as Appendix F ***(see Section 1311)***.

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696 FORMS INDEX

696-1 Maintenance of Traffic Alternative Analysis - Work Zone Constraints

Form 696-1 is submitted as part of the Maintenance of Traffic Alternative Analysis described in ***Section 630-5*** for projects involving Interstates and Interstate Look-alikes.

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Form 696-1. Work Zone Constraints

Work Zone Constraints		
Constraint	Work Zone Alternatives	
	Part-Width Construction	Crossover Construction
Ability to meet Work Zone Policy		
Ability to maintain all accesses		
Ability to provide required on-ramp merge decision sight distance.		
Right-of-way impacts		
Environmental impacts		
Final bridge widths		
Significant impacts for construction duration and/or construction costs		
Significant impacts to earthwork, retaining walls, pier clearances, profile differences, etc.		
Ability to maintain existing drainage and lighting systems		
Constructability; and construction equipment access		
Location of crossovers (e.g., Can crossovers be located near the project?)		

Notes:
1. Where a constraint is identified, it should be clear in which phase(s) of construction the constraint will be present; and
2. It should be footnoted and an explanation should be provided after the table in the analysis report. The explanation should provide sufficient information for **ODOT** to determine the magnitude of the constraint.
3. Examples of constraint footnoted information are provided in ***Section 630-5***.

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697 TABLES INDEX

697-1a Construction / Traffic Maintenance Strategies

As noted in ***Sections 606-16, 630-2 and 640-25.3***, ***Tables 697-1a through 697-1f*** present a Compendium of Traffic Control Options of various traffic control strategies and traffic control options. ***Table 697-1a*** addresses construction and traffic maintenance strategies in general.

697-1b Corridor Options Outside Work Zones

As noted in ***Sections 606-16, 630-2 and 640-25.3***, ***Tables 697-1a through 697-1f*** present a Compendium of Traffic Control Options of various traffic control strategies and traffic control options. ***Table 697-1b*** addresses corridor options outside the work zone.

697-1c Traffic Flow Options Inside Work Zones

As noted in ***Sections 606-16, 630-2 and 640-25.3***, ***Tables 697-1a through 697-1f*** present a Compendium of Traffic Control Options of various traffic control strategies and traffic control options. ***Table 697-1c*** addresses traffic flow options inside work zones.

697-1d Time Limitations With Liquidated Damages Option

As noted in ***Sections 606-16, 630-2 and 640-25.3***, ***Tables 697-1a through 697-1f*** present a Compendium of Traffic Control Options of various traffic control strategies and traffic control options. ***Table 697-1d*** addresses time limitations with a liquidated damages option.

697-1e Contracting Procedure Options

As noted in ***Sections 606-16, 630-2 and 640-25.3***, ***Tables 697-1a through 697-1f*** present a Compendium of Traffic Control Options of various traffic control strategies and traffic control options. ***Table 697-1e*** addresses contracting procedures options.

697-1f Administrative Options

As noted in ***Sections 606-16, 630-2 and 640-25.3***, ***Tables 697-1a through 697-1f*** present a Compendium of Traffic Control Options of various traffic control strategies and traffic control options. ***Table 697-1f*** addresses various administrative options.

697-2 Rate of Flow (Two-Way) for a Signalized One-Lane, Two-Way Closing

As noted in ***Sections 641-12.2***, ***Table 697-2*** provides rate of flow (two-way) information for use in designing a signalized one-lane, two-way closing related to the length of the one-lane operation.

697-3 Initial Timing Chart

As noted in ***Sections 641-12 and 641-13***, ***Table 697-3*** presents an example of a timing chart that could be used in a plan involving a signalized one-lane, two-way closing to indicate specified signal timing.

697-4 Minimum Lane Widths for Maintaining Traffic on Curves (Where D>10 degrees)

As noted in ***Section 640-2***, ***Table 697-4*** establishes minimum lane widths for maintaining traffic on sharp curves (degree of curvature exceeds 10 degrees).

697-5 Sample Phasing Chart for Actuated Signal Control

As noted in ***Sections 641-12.3 and 641-13.3***, ***Table 697-5*** presents a sample phasing table that can be used in the plan.

697-6 Selection of Crash Cushions and Barriers - TRACC and Triton

As noted in ***Sections 605-14.5, 605-15.2.3 and 642-32***, ***Table 697-6*** presents resource information for use when selecting crash cushions.

697-7 Selection of Crash Cushions - QuadGuard

As noted in ***Sections 605-15.2.2 and 642-31***, ***Table 697-7*** presents resource information for use when selecting a QuadGuard crash cushion.

697-8 Maximum Closure Lengths

As noted in ***Section 641-12.2***, ***Table 697-8*** provides guidance in designing a signalized one-lane, two-way closing. These values are used as a guide as to when a more detailed analysis of the traffic is needed.

697-9 Barrier Offset on Curved Roadways

As noted in ***Section 641-24***, ***Table 697-9*** summarizes required offsets for barriers on curved roadways.

Table 697-1a. Construction / Traffic Maintenance Strategies Compendium of Traffic Control Options

Strategy & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Part Width Construction	Easier design. Cheaper MOT cost. No detour to follow. Ramps can remain open.	Contractor access interference. May sacrifice quality. More difficult to construct. Narrow lanes and less safe. Longer to construct. Barrier could still be required for some dropoffs.	Minimum lane widths sometimes tough to obtain. Conflict between width of roadway and width needed for work.	When existing two lanes can remain with use of shoulder. Minor work with short duration. One lane may handle only 20,000 ADT with normal backup.	This is the basis of comparison for alternate strategies, the "defacto" standard.
Close & Detour **(Unusual on Interstates and expressway routes)** **3**	Safety/ speeds up construction with full access. Easier and better construction. No distracting traffic.	Public can't get there the "usual" way. Access to businesses. Cost to motorist (time & fuel). Signing. Lost road users complaints. Damage of local roads.	Short distance and ramp access. Local agencies must accept detour and public information is emphasized (i.e., by TMP in urban area). Locations of ramps and intersections. Detour must be adequately signed and may require capacity improvements.	If it produces accelerated construction, alternates are available and drivers are fairly warned.	CC↓, MTC↑, RUC↑ Cheap if only signs are used; but will cost more if alternate route modifica-tions are required. Detours-usually signed by ODOT.

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety

Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1a. Construction / Traffic Maintenance Strategies - Compendium of Traffic Control Options (continued, 2 of 3)

Strategy & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Crossover Construction **3, 4**	Safety for workers, familiarity of road user. Easier and better construction. Wider traveled lanes. If left in place, useful in emergency. Should increase contractor productivity. Should increase quality. Could reduce traffic interference as a result of increased contractor productivity leading to shorter phase. Completion dates are mandated.	Ramp interference. Cost. Requires time for crossover construction and removal. Long crossovers less acceptable in rolling to hilly terrain.	Duration of project. Location of crossover depends on ramps, lighting, structure and grade. Phasing limits may impact use. Length of work zone may affect acceptability.	Whenever possible, especially where not many ramps interfere. Long stretches of pavement reconstruction or rehabilitation. Bridge work not conducive to keeping one lane open. One lane each direction should handle about 30,000 ADT with limited backups.	CC↓, MTC↑, RUC↓ Minimum $¼ to ½ million per pair.
Temporary Pavements (Runaround) **1, 2, 3, 4**	Separates work from traffic.	Expensive and time consuming while constructing. Inefficient use of materials.	Must have sufficient right-of-way.	No adequate detour is available.	MTC↑, RUC↓

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1a. Construction / Traffic Maintenance Strategies - Compendium of Traffic Control Options (continued, 3 of 3)

Strategy & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Temporary Structures **(Allows closure of structure, but no detour for the public)** **1, 2**	Traffic remains on routes.	Cost. Time to design and construct. Inefficient use of materials.	Right-of-Way.	When volumes warrant. No detour available.	MTC↑, RUC↓
Detour of One Direction of Mainline **(Assumes detour for closed direction)** **3, 4**	Work moves faster. Only half of the traffic detoured at anytime. Improves safety of project personnel.	Detour maintenance.	Short distance and ramp access. Local agencies must accept detour routes and public information is emphasized (i.e., by TMP in urban area). Locations of ramps and intersections. Detour must be adequately signed and may require capacity improvements.	Often. Urban/ suburban freeway is amenable to this when suitable detour is available.	MTC↑ Could require detour improve-ments.

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1b. Corridor Options Outside Work Zone Compendium of Traffic Control Options

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Temporary Signals **(At ramps and on expressways, includes construction vehicle crossing and ramp metering)** **1, 2, 4**	Helps maintain ramp and detour capacity.	Change traffic patterns on cross roads.	Should be warranted.	When additional capacity is needed for the short term.	Low.
Reversible Lanes **(May use movable barriers)** **2**	Flexible to accommodate fluctuations in traffic peak flow direction.	Confusing to infrequent user. Labor intensive.	Need majority commuting traffic.	Large variances in directional volumes between AM & PM; and number of lanes limited.	MTC↑, RUC↓
Movable Barrier Systems **2, 3, 4**	Ability to provide for peak flow capacity.	More costly than drums and fixed barriers.	Shift distance must be a constant. Must determine appropriate end treatment.	When you have a need for repeated barrier shifts.	CC↑, RUC↓
Signed Alternate Routes **(Eligible for Federal money)** **1, 2, 4**	Reduces congestion. Lessens congestion on mainline.	Hard to get people to use. Signing. Not always used by public.	Must be just as quick or close. Shouldn't go through other construction zones. Local officials must approve.	With good arterials (parallel). When construction expected to backups. Project is of long duration.	Low cost unless alternate route improve-ments are required.

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety

Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1b. Corridor Options Outside Work Zone - Compendium of Traffic Control Options (continued, 2 of 2)

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Unsigned Alternate Routes **(Not eligible for Federal money)** **(Logical unsigned alternate may be eligible for State money)** **1, 2**	Reduces congestion. Lessens congestion on mainline.	Difficult to get people to use.	Alternate routes shouldn't go through other construction zones.	When construction expected to produce backups and good parallel arterials are available.	
Highway Advisory Radio **1**	Provides real time information to motorists.	Limited ranges. Low usage rate by motorists due to difficulty tuning in station.	Information needs to be current. May work best with repeat drivers. Should be limited to project specific information.	When alternate routes are available. Long duration of construction.	Low cost.
Advanced Signing (Time or Distance) **1, 2, 4**	A great tool for information to motorists. Gives public advance warning to make decisions.	If project is delayed, sign is wrong.	Need to keep information up to date.	Anytime. Advanced warning/PR is great always.	Low cost for fixed. Addition to MOT, unless PCMS is used at $3000 per month.

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1c. Traffic Flow Options Inside Work Zones Compendium of Traffic Control Options

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Temporary Pavements **(Widen)** **1, 2, 4**	Allows for more lanes to stay open. Creates greater capacity through the construction zone - less backups.	Expensive and time consuming while constructing.	Bridges and other roadway items.	When volumes warrant keeping all lanes open. When construction is expected to produce backups. When project is of long duration.	MTC↑, RUC↓
Use Existing Shoulders **1, 2**	Keeps flow normal. Allows wider work space or increases capacity. Low cost. Quick.	Requires more maintenance. Trucks may damage weak shoulders. No room for breakdowns/ emergency stops unless parking lots created. Closer to guardrail, embankment and piers.	Must have full shoulder widths, level bridges. Bridges must be able to accommodate. Put trucks in left lane if possible. Must evaluate shoulders during design. Should have full width approach slabs.	High volume. When backups expected. Moving projects.	

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1c. Traffic Flow Options Inside Work Zones - Compendium of Traffic Control Options (continued, 2 of 4)

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Temporary Signals **(At ramps and on express-ways includes construction vehicle crossing and ramp metering)** **1, 2, 4**	Helps maintain ramp and detour capacity.	Change traffic patterns on cross roads.	Should be warranted.	When additional capacity is needed for the short term.	Low.
Reversible Lanes **(May use movable barriers)** **2**	Flexible to accommodate fluctuations in traffic peak flow direction.	Confusing to infrequent user. Labor intensive.	Need majority commuting traffic.	Large variances in directional volumes between AM and PM; and number of lanes limited.	MTC↑, RUC↓
Movable Barrier Systems **2, 3, 4**	Ability to provide for peak flow capacity.	More costly than drums and fixed barriers.	Shift distance must be a constant. Must determine appropriate end treatment.	When you have a need for repeated barrier shifts.	MTC↑, RUC↓

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1c. Traffic Flow Options Inside Work Zones - Compendium of Traffic Control Options (continued, 3 of 4)

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Ramp Closures **2, 3, 4**	Can pave/repair ramp full width. Better, safer construction. See "Close & Detour." Reduces mainline congestion. Reduces cross road congestion. Easy to sign in rural area.	Blocks traffic pattern. See "Close & Detour." Forces new traffic pattern. Moves congestion elsewhere. In urban area, may have negative impact on next intersection.	Should give definite time limit. See "Close & Detour." Best if only two ramps at a time (to and from directional pairs).	When other ramps are close by, or when bridges on mainline are too close to utilize exit and/or entrance ramps. See "Close & Detour." Use when you have high-traffic volumes. In areas where alternate routes exists.	Relatively cheap. See "Close & Detour."
Glare/Gawk Screens **2, 4**	Effective way to separate work and keep traffic moving. Safer for work. Reduce rubber-necking.	Longer to set up than drums. Higher cost than 32 inches (813 millimeters). Maintenance of glare screen, if used. If present on both sides, may reduce drive speed. Barrier can interfere with wide loads.	Widths in certain areas. Sight restrictions at intersections and ramps.	When view of intense construction is likely to reduce capacity. With all part-width construction at restricted areas to control headlight glare.	MTC↑

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety

Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1c. Traffic Flow Options Inside Work Zones - Compendium of Traffic Control Options (continued, 4 of 4)

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Highway Advisory Radio **1**	Provides real time information to motorists.	Limited ranges. Low usage rate by motorists due to difficulty tuning in station.	Information needs to be current. May work best with repeat drivers. Should be limited to project specific information.	When alternate routes are available. Long duration of construction.	RUC↓
Owner Imposed Design Restrictions **1, 3**	Can reduce actual construction duration.	Requires advance planning during design. Could increase cost.		For certain time critical phases.	
Use of Owner Supplied or Stockpiled Materials **1, 3**	Can reduce actual construction duration.	Requires advance planning.		For time-critical phases to shorten duration.	Inexpensive.
Control of Contractor's Access to the Work **(By location or time of day.)** **2, 4**	Eliminates potential conflicts between construction traffic and motorist. Improves through put of motorists.	May reduce contractor productivity.	Must provide reasonable access for contractor.	Where capacity is critical. Where conflicts between contractor's equipment and motorists is expected to impact capacity and safety, possibly on grades or locations with poor sight distances.	CC↑, RUC↓

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety

Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1d. Time Limitations with Liquidated Damages Options Compendium of Traffic Control Options

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Temporary Lane Closures or Restrictions **1, 2**	Prevents contractor from keeping lanes closed longer than necessary. Prevents work during specified hour.	May surprise repeat drivers. May be more expensive. More setups and take downs which can reduce construction time.	Rush hour considerations. Use only if work will allow. Give public notices.	Mainline paving on basic freeway lanes. When desired to prohibit closures during specified times.	CC↑, MTC↑, RUC↓ Cheap (cone in daylight; drums at night). Possibly higher cost than permanent closure.
Night Work **(Hours of day a specific phase of work is or required to be performed)** **2, 3**	Good PR. Lower cost to motorist. May shorten project duration.	Costly for labor. Lower efficiency. Personnel are isolated. Possibly poorer quality work and inspection difficulty. Difficult to get some materials at night. Increased hazard potential. Difficult to access management or supervision for problem solution.	Residential areas. Work must be able to be accomplished in this time. Urban noise ordinances.	High-volume areas. When extensive backups expected to be created.	CC↑, MTC↑, RUC↓

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1d. Time Limitations with Liquidated Damages Options - Compendium of Traffic Control Options (continued, 2 of 2)

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Weekend Work (Only) **2, 3, 4**	Lower cost to motorist.	Costly - needs inspection on overtime also. Impacts traveler who is less familiar with alternate routes. Difficult to get some materials on weekends.	Work must be able to be accomplished in this time.	More amenable in urban areas. High volume of commuter traffic expected to be delayed.	CC↑, RUC↓
Lane Rental **(Many variations)** **(Contractor loses money for duration of specific lane closures)** **1, 2, 3**	Work done in the most cost effective and timely manner. Should minimize construction time. Provides incentive to minimize use of road space.	Expect disagree-ments. New application in Ohio.	Requires careful timekeeping. Too many variables.	Paving freeways.	CC↑, RUC↓
Interim Completion Dates, By Phase **3 (possibly 4)**	A good tool for timeliness. Prevents contractor from having lanes closed or restricted when not desired.	Only works if enforced by increased liquidated damages.	Schools, weather, plowing, etc. Must require early consideration and follow-up. Must be updated when a sale date is established or revised.	To open roads before winter, specified events.	Cheap.

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1e. Contracting Procedure Options Compendium of Traffic Control Options

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Incentives/ Disincentives **(Usually applies to a phase of a project)** **1, 3**	Timeliness. Quicker construction.	More arguments on time extension. Our people must resolve issues quickly. Requires CPM schedule.	None known. Need good plans and a project with the work well defined in advance. Work must be able to be accomplished in allotted time, must follow the incentive/ disincentives guidelines.	High volume that truly impacts motorists without good detour or alternate route.	CC↑, RUC↓ Must budget for maximum incentive.
A + B Bidding **(Construction cost plus construction time)** **1, 3**	Work done in the most cost effective and timely manner. Should minimize construction time.	May pay more for the work. Expect disagreements.	Limit to high impact projects. Currently limited to test projects. Need very good plans and no expected changes. Need reasonable completion times.	High volume that truly impacts motorists without good detour or alternate route.	CC↑, RUC↓

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1e. Contracting Procedures Options - Compendium of Traffic Control Options (continued, 2 of 2)

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Lane Rental **(Many variations)** **(May be combined with A+B Bidding)** **(Contractor loses money for duration of specific lane closures)** **1, 2, 3**	Work done in the most cost effective and timely manner. Should minimize construction time. Provides incentive to minimize use of road space.	Expect disagreements. New application in Ohio.	Requires careful timekeeping.	Paving freeways.	CC↑, RUC↓

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety
Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1f. Administrative Options
Compendium of Traffic Control Options

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Traffic Management Program **(Area, corridor or project)** **(May include enforcement, demand management, public information, public perception adjustment)** **1, 2, 4**	Keeps checks on conflicts. Helps with consistency. Coordinates all projects, develops a forum for discussion of construction problems.	Not welcomed by some. Takes extra time and planning. Tends to be expensive. Additional funding required from Districts and Locals. Project outside area boundaries may cause public relation problems. Requires more staff time.	Takes extra time and planning. Area must be large enough to make worthwhile.	Anytime. Most often used in larger urban areas and particularly (eight MPO's) with large projects.	CC↑, MTC↑, RUC↓ Personnel only (mainly). Typical program is $500,000 to $1 million per year.
Enforcement **1, 2, 4**	Expedited, orderly traffic flow, incident support.	Cost.		When incident support is required, or enforcement presence is desired.	Medium high.
Incident Management **1, 2, 3, 4**	Minimizes effect incidents have on traffic flow.	Cost of standby incident response personnel and vehicles; administrative cost.		Freeway sections with high v/c ratio and high likelihood of incidents.	High.

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety

Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-1f. Administrative Options -
Compendium of Traffic Control Options (continued, 2 of 2)

Option & Objectives	Pros	Cons	Restrictions	When to Use	Cost
Demand Management **1, 2, 3, 4**	Shifts some demand from highway under construction. Good PR.	Requires advance planning and coordination. Cost.	Alternative routes and modes must be available.	Large urban and suburban projects in congested corridor.	High.
Contractor Proposed Options **3**	May result in shorter construction duration.	Contractor may not be as familiar with recommended procedure as claimed. Usually requires rush reviews by ODOT.	Requires adequate lead time for PR and permits.		CC↓

Legend:
Objectives: 1 = Reduce Complaints; 2 = Maximize Corridor Capacity; 3 = Minimize duration of motorist inconvenience; 4 = Maximize motorist / worker safety

Cost: CC = Construction Cost; MTC = Maintenance of Traffic Cost; RUC = Road User Cost; ↑= Cost Increase; ↓= Cost Decrease; CC + MTC = Contract Cost

Table 697-2. Rate of Flow (Two-Way) for a Signalized One-Lane, Two-Way Closing

Total cycle length		Length of One-Lane Operation feet (meters)						
Minutes	Seconds	400 (122)	500 (152)	600 (183)	700 (213)	800 (244)*	900 (274)*	1000 (305)*
1.0	60	450	310	170	35			
	70	570	445	320	200	80		
	80	690	579	475	365	260	155	
1.5	90	810	715	625	530	440	350	225
	100	870	780	700	615	530	445	340
2.0	120	990	915	844	788	712	638	572
3.0	180 *	1154	1117	1075	1027	983	934	890
4.0	240 *	1247	1215	1184	1151	1118	1081	1048
5.0	300 *	1302	1276	1253	1226	1200	1170	1144

This table assumes a 12 foot (3.6 meters) lane width. If the lane width is 11 feet (3.4 meters), reduce the rate of flow by using a factor of 0.97 and for a 10 foot (3.0 meters) lane width, reduce the rate of flow by using a factor of 0.93.

* Cycle lengths greater than three minutes should be considered only in unusual cases. It is important to remember that a road user encountering a signal staying red for more that two minutes is very likely to become impatient and/or assume the signal is malfunctioning. This is particularly true if the motorist cannot see that opposing traffic is using the open lane. For the same reasons, closure lengths greater than about 800 feet (244 meters) should not be used until carefully evaluated. Where relatively short closure lengths are involved but high peak traffic volumes tend to support the need for a longer cycle length, it will probably be appropriate to employ a technique which will allow a shorter cycle length to be used during lower traffic periods. Traffic actuated operation and/or multi-plan time-of-day operation should be considered.

Table 697-3. Initial Timing Chart

	TIMING PLAN (SEC)		
Approach	**A**	**B**	**C**
Northbound Green	31.0*	41.0	16.0*
Northbound Yellow	3.5	3.5	3.5
Northbound All Red (Internal Clearance)	18.0	18.0	18.0
Southbound Green	30.0	20.0	15.0
Southbound Yellow	3.5	3.5	3.5
Southbound All Red (Internal Clearance)	19.0	19.0	19.0
Total Cycle Length	105.0*	105.0	75.0*

* Provide timing appropriate for the signal location under consideration.

Time of Day	SUN	MON	TUE	WED	THUR	FRI	SAT
Midnight - 7:00 a.m.	C*	C	C	C	C	C	C*
7:00 a.m. - 9:00 a.m.	C	A	A	A	A	A	C
9:00 a.m. - 4:00 p.m.	A	C	C	C	C	C	A
4:00 p.m. - 6:00 p.m.	C	B	B	B	B	B	A
6:00 p.m. - Midnight	C*	C	C	C	C	C	C*

Table 697-4. Minimum Lane Widths for Maintaining Traffic on Curves
(Where D >10 degrees)

	Predominant Traffic Type **		
RADIUS feet (meters)	Type A feet (meters)	Type B feet (meters)	Type C feet (meters)
> 500 (>150)	10 (3.0)	10 (3.0)	10 (3.0)
500 (150)	10 (3.0)	10.5 (3.15) *	11.5 (3.45) *
300 (90)	10 (3.0)	11.0 (3.3) *	12.5 (3.75) *
200 (60)	10 (3.0)	11.5 (3.45) *	13.5 (4.05) *
150 (45)	10 (3.0) *	12.0(3.6) *	14.5 (4.35) *
100 (30)	10 (3.0) *	13.5 (4.05) *	17.0 (5.1) *

** Type A - Passenger cars govern design.

Type B - Single unit trucks govern design.

Type C - Semitrailer vehicles (WB-50) govern design. Larger units may need to be rerouted if their required width cannot be accommodated.

Note: Widths shown in excess of 10 feet (3.0 meters) are based on the width of wheel track plus a 1.5 foot (0.45 meter) allowance for maneuverability. Minimum barrier offset in addition to the widths shown is 1.5 foot (0.45 meter). Values marked by an asterisk (*) are those situations where minimum barrier clearance cannot be waived.

Table 697-5. Sample Phasing Chart for Actuated Signal Control

	PHASE*			
	1	**2**	**3**	**4**
Initial	7+/-	10	8	10+/-
Vehicle	4	3	4	3
Maximum	11	30	12	30
Yellow	3	3.5	3	3.5
All Red	2	2	2	2
Recall	ON+/-	OFF	ON	OFF+/-

* Phases as shown on **SCD MT-96.26** for Actuated Control.
+/- Provide timing for the signal location under consideration.

Table 697-6. Selection of Crash Cushions - TRACC and Triton

Drawing Number	Drawing Name	Drawing Revision Date	ODOT Approval Date*
SS450 SS450m	Crash-cushion Attenuating Terminal Plan, Elevation & Sections	3/12/99 Rev. 1 3/12/99 Rev. 1	8/27/99 8/27/99
SS455	TRACC Transition to W-beam Median Barrier Plan, Elevation & Sections	2/18/99	8/27/99
SS461	TRACC Transition to Concrete Safety Shape Barrier Plan, Elevation & Sections	6/30/99 Rev. 1	8/27/99
SS462	TRACC Transition to Concrete Barrier Single Slope Plan, Elevation & Sections	6/30/99	8/27/99

Drawing Number	Drawing Name	Drawing Revision Date	ODOT Approval Date*
35-95-02	Barrier Section Assembly, Triton Barrier	10/25/96 Rev. G	8/27/99
3595361	Triton Barrier TI-3 End Treatment	1/12/98 Rev. A	8/27/99

* Contact the **Office of Roadway Services** for to confirm the latest approval dates.

Table 697-7. Selection of Crash Cushions - QuadGuard

Drawing Number	Drawing Name	Drawing Revision Date	ODOT Approval Date*
QSCZCVR-T4	QuadGuard CZ System for Construction Zones	5/13/99 Rev. J	8/27/99
35-40-10	QuadGuard System Concrete Pad, CZ, QG	11/19/97 Rev. D	8/27/99
35-40-16	Quadguard System Backup Assembly, CZ, QG	7/30/99 Rev. F	8/27/99
354051z	QuadGuard CZ System Nose Assembly, CZ, QG, 24, 30, 36	5/17/99	8/27/99
35-40-18	Transition Assembly, 4 Offset, QuadGuard	6/25/99 Rev. F	8/27/99
35400260	QuadGuard System PCMB Anchor Assembly	11/19/97 Rev. C	8/27/99

* Contact the **Office of Roadway Engineering Services** for to confirm the latest approval dates.

QuadGuard CZ Model #s for Units Approved for Use in Ohio on the NHS*					
# of bays	**Work Zone Design Speed** miles per hour (kilometers/hour)	**System Length** feet (meters)	**Unit Width**		
			24 inches (610 mm)	30 inches (762 mm)	36 inches (915 mm)
3	40 (70) and below	13'-1" (4.00)	QZ2403Y	QZ3003Y	QZ3603Y
6	over 40 (70)	22'-1" (6.74)	QZ2406Y See note 2.	QZ3006Y	QZ3606Y

* See ***Section 130-5*** for information about the National Highway System (NHS).

Table 697-8. Maximum Closure Lengths

MAXIMUM ADT	MAXIMUM CLOSURE LENGTH Feet (Meters)
10,000	200 (61)
9,000	400 (122)
8,000	600 (183)
7,000	800 (244)
5,000	1200 (366)
4,000	1600 (488)
3,000	2000 (610)

Table 697-9. Barrier Offset on Curved Roadways

Degree of Curvature (Radius Meters)	Required Offset From Edge of Pavement Feet (Meters)	Minimum Width of Median Required Feet (Meters)
2.5 to 3.5 (1250 to 900)	36 (11)	66 (20)
3.6 to 4.5 (899 to 700)	42 (13)	72 (22)
4.6 to 5.5 (699 to 500)	48 (15)	78 (24)

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698 FIGURES INDEX

698-1 Component Parts of a Traffic Control Zone

As noted in ***Sections 602-4.1, 602-4.4.4 and 605-5.1***, ***Figure 698-1*** illustrates the components of a traffic control zone.

698-2 Saved for later revision.

Figure deleted but the space has been saved for now.

698-3a&b Temporary Traffic Control Signs

As noted in ***Section 605-2.1***, ***Figures 698-3a and 698-3b*** illustrate Regulatory, Warning and Guide Signs discussed in this Manual that are not shown in the **OMUTCD**.

698-4 Median Crossover for Entrance Ramp

Figure 698-4 illustrates a typical application involving a median crossover for an entrance ramp. ***Section 607-13*** provides additional information directly related to this application. ***Section 606-17*** also provides additional information about work near interchanges.

698-5 Work in Vicinity of Entrance Ramp

Figure 698-5 illustrates a typical application involving work in the vicinity of an entrance ramp. ***Section 607-15*** provide additional information directly related to this application. ***Section 606-17*** also provides additional information about work near interchanges.

698-6 Two-Lane Crossover Design (Existing 4-Lane Facility)

Figure 698-6 illustrates a two-lane crossover design for an existing four-lane facility. ***Sections 606-16, 607-12 and 640-12*** address crossovers.

698-7 Example of Typical Sections (Existing 4-Lane Facility)

Figure 698-7 illustrates typical sections for a median crossover on an existing four-lane facility. ***Sections 606-16, 607-12 and 640-12*** address crossovers.

698-8 Two-Lane Crossover Design (Existing 6-Lane Facility)

Figure 698-8 illustrates a two-lane crossover design for an existing six-lane facility. ***Sections 606-16, 607-12 and 640-12*** address crossovers.

698-9 Example Typical Sections (Existing 6-Lane Facility)

Figure 698-9 illustrates typical sections involving a median crossover for an existing six-lane facility. ***Sections 606-16, 607-12 and 640-12*** address crossovers.

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Figure 698-1. Components of a Traffic Control Zone

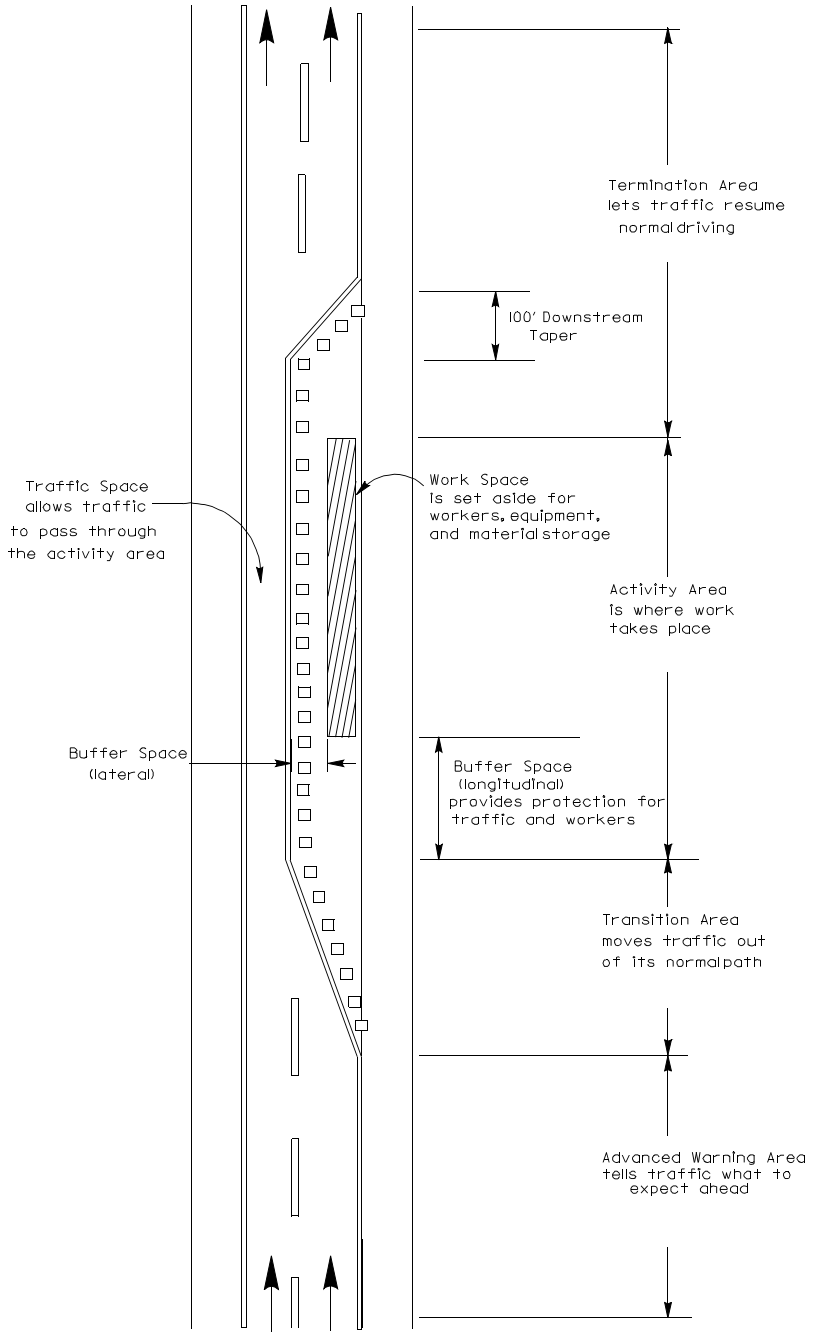


Figure 698-2.

Figure has been deleted; however, for now the space has been saved for a future revision.

Figure 698-3a. Temporary Traffic Control Signs

M2-H3
605-7.3

M4-H9bR
605-7.2

R11-H5a
605-4.3

W3-H7
642-33

W8-H12
605-5.15

W8-H13
605-5.15

W8-H16
605-17

W9-H4R
641-17

W9-H5
641-17

W9-H6
641-17

W20-7
605-5.7

W20-H10
607-10

Figure 698-3b. Temporary Traffic Control Signs (continued)

W20-H11
607-10

W20-H12
607-10

W20-H13
605-8.3

W20-H14
605-8.3

W21-H5
606-6

W21-H6
605-5.9

W21-H8
606-6

W23-H2
607-15

Figure 698-4. Median Crossover for Entrance Ramp
(See Section 607-13 for related details.)

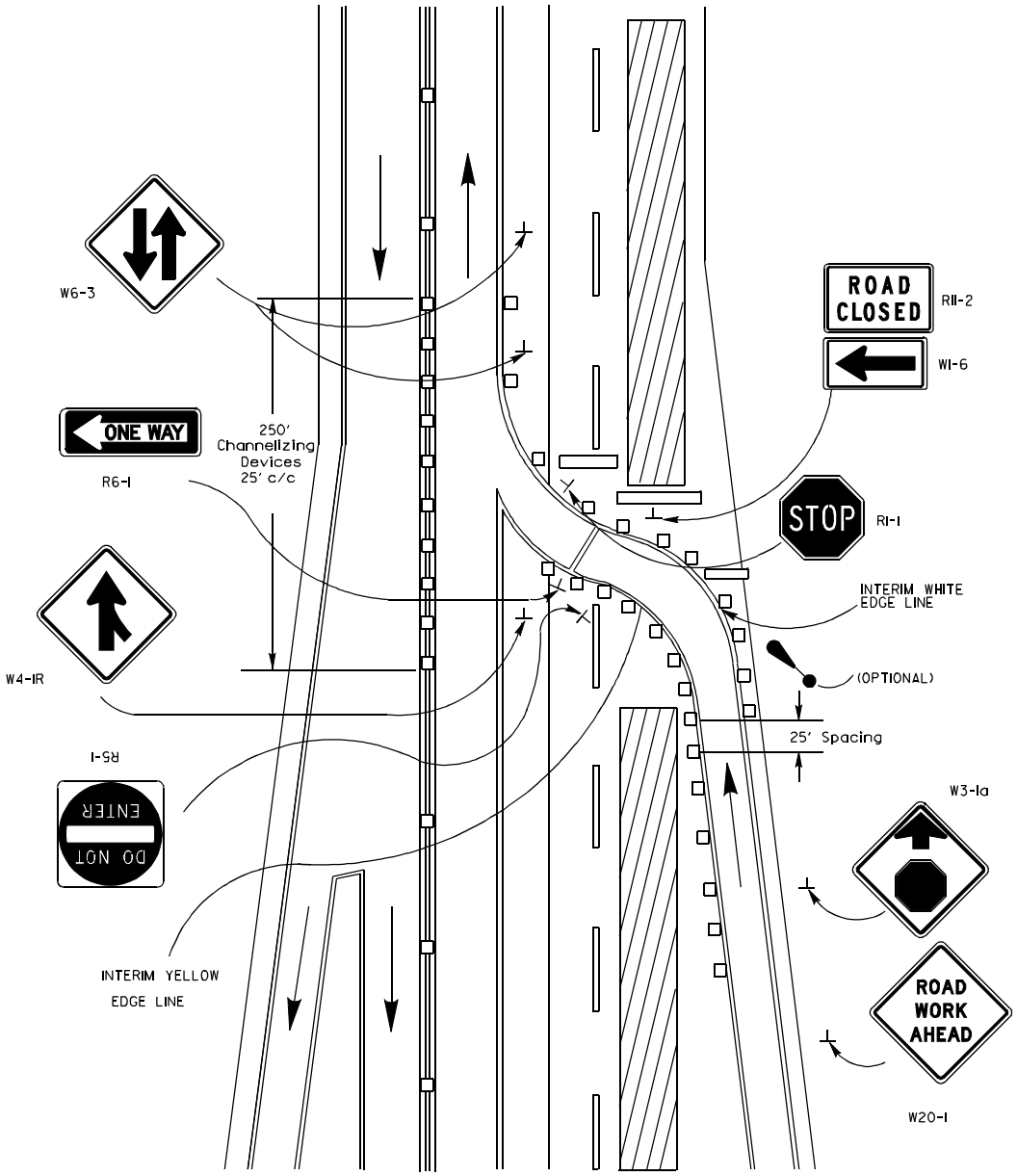


Figure 698-5. Work in Vicinity of Entrance Ramp
(See Section 607-15 for related details.)

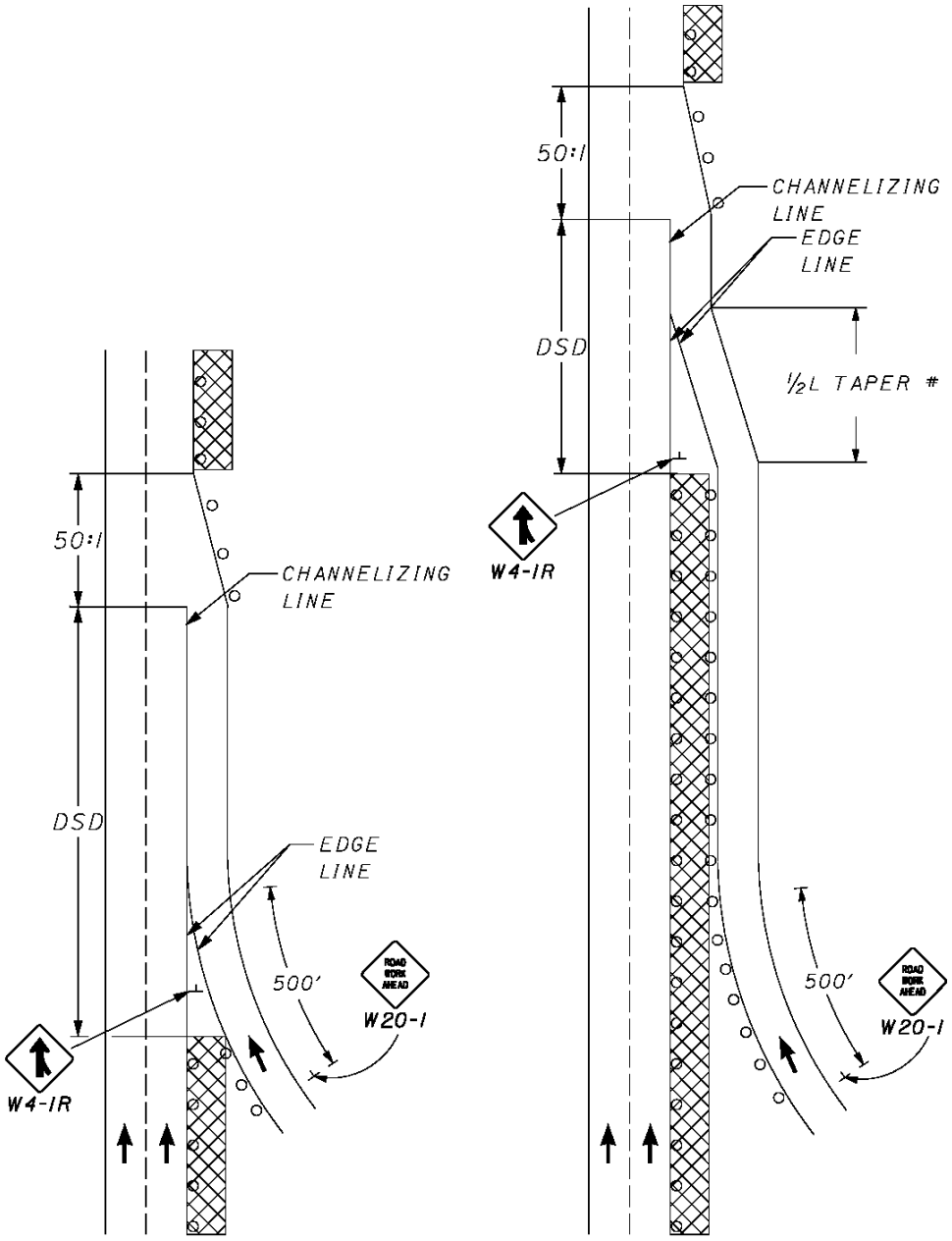
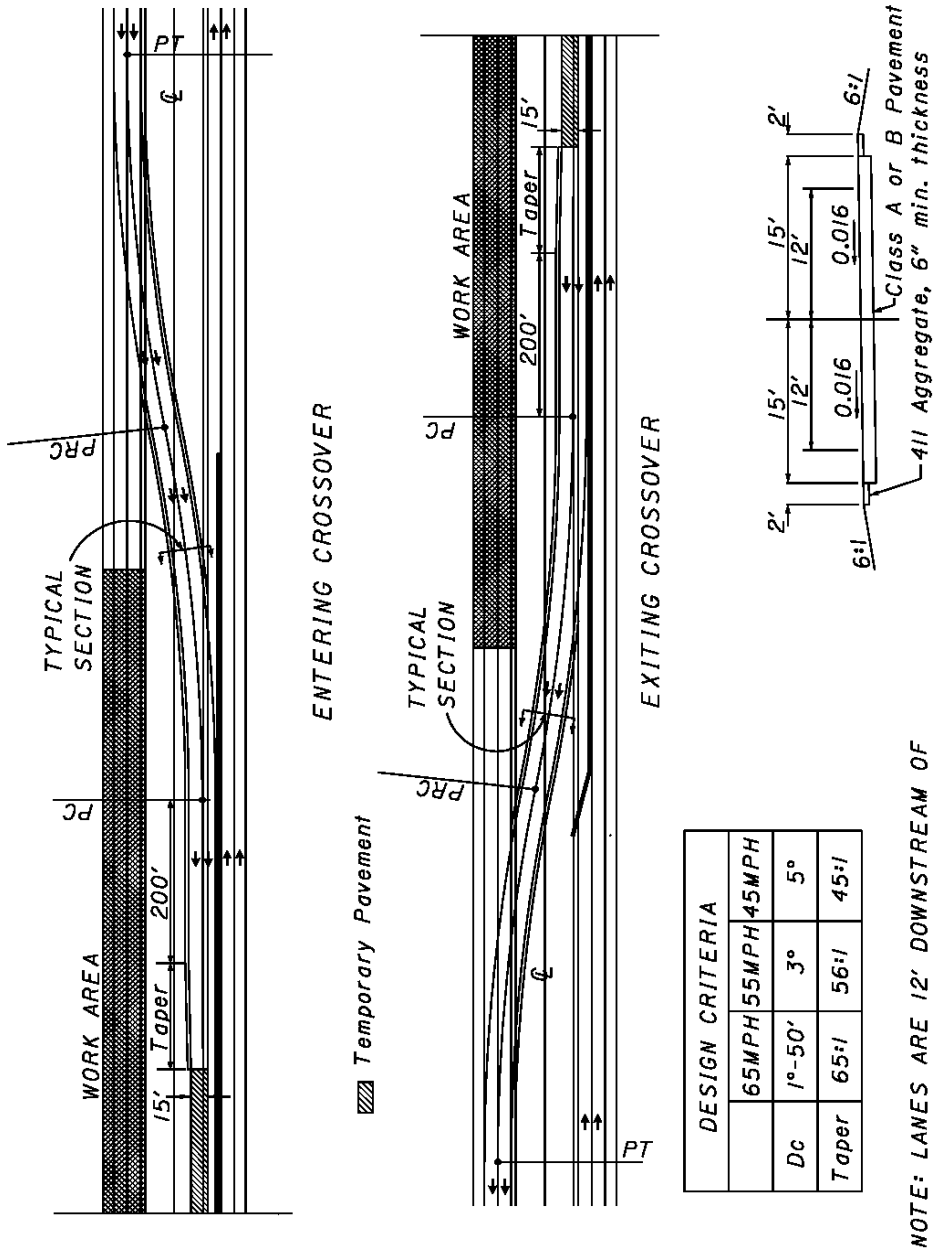


Figure 698-6. Two-Lane Crossover Design (Existing 4-Lane Facility)



DESIGN CRITERIA			
	65MPH	55MPH	45MPH
Dc	1°-50'	3°	5°
Taper	65:1	56:1	45:1

Figure 698-7. Example of Typical Sections (Existing 4-Lane Facility)

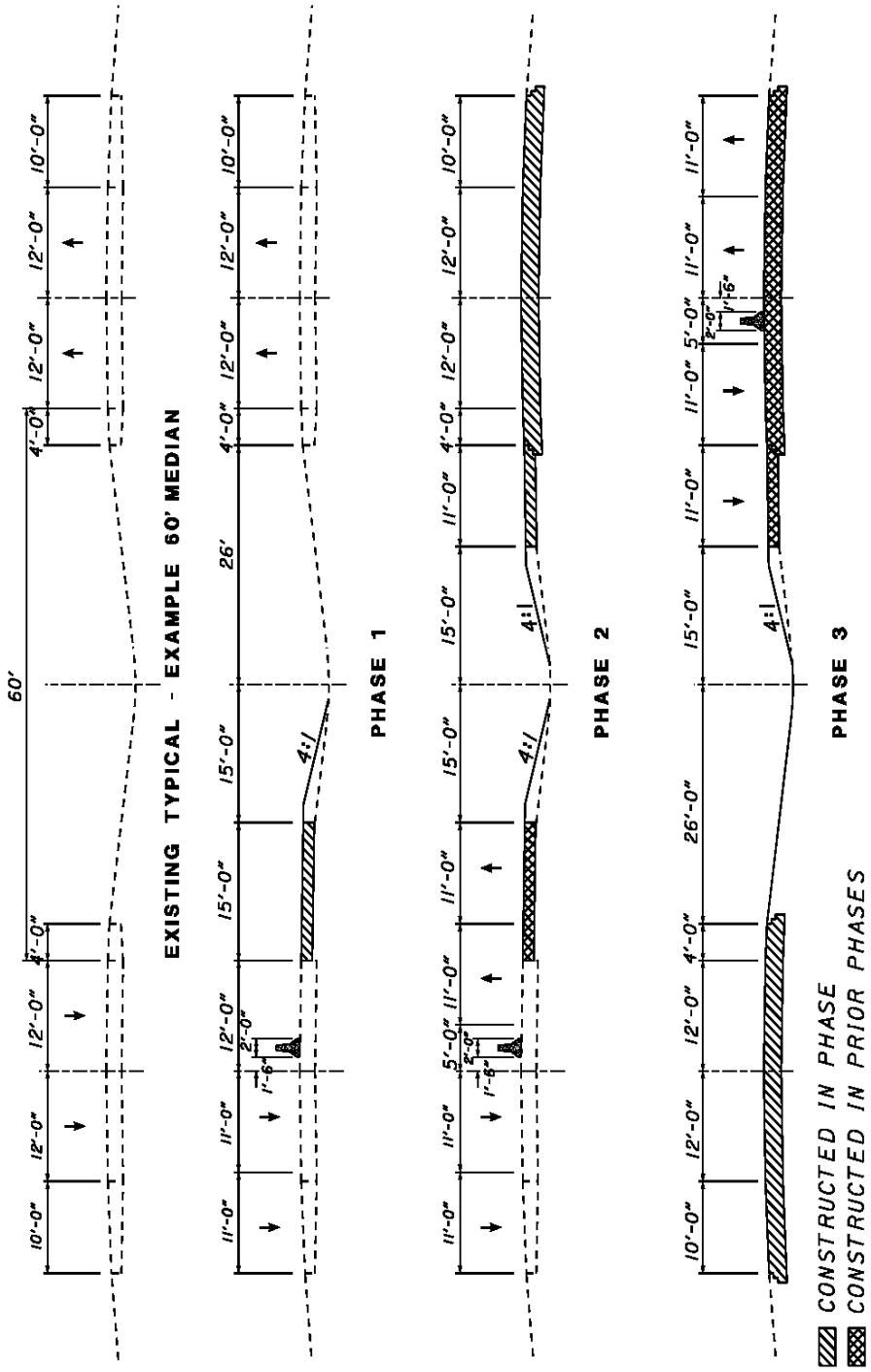
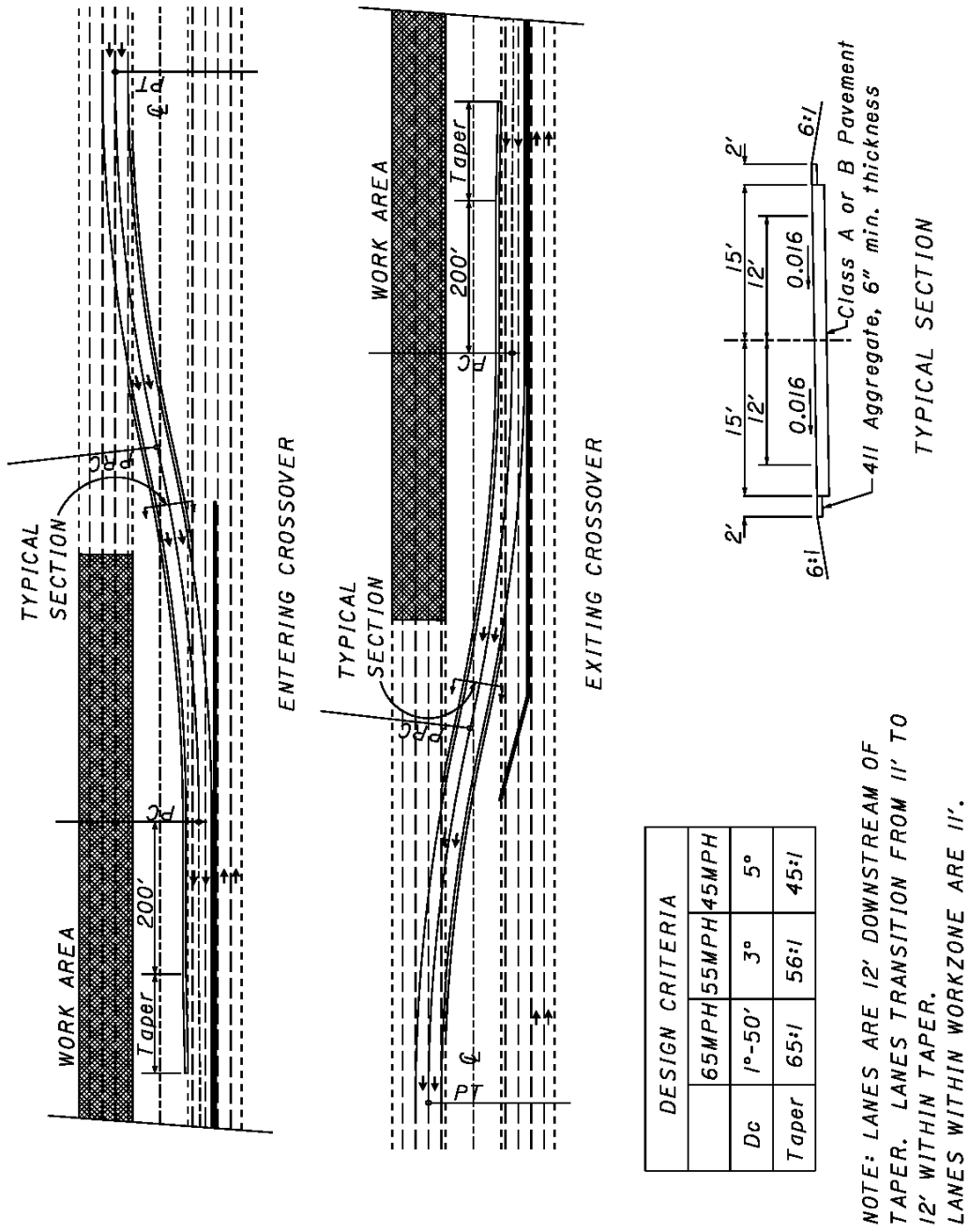


Figure 698-8. Two-Lane Crossover Design (Existing 6-Lane Facility)



DESIGN CRITERIA			
	65MPH	55MPH	45MPH
Dc	1°-50'	3°	5°
Taper	65:1	56:1	45:1

NOTE: LANES ARE 12' DOWNSTREAM OF TAPER. LANES TRANSITION FROM 11' TO 12' WITHIN TAPER.
LANES WITHIN WORKZONE ARE 11'.

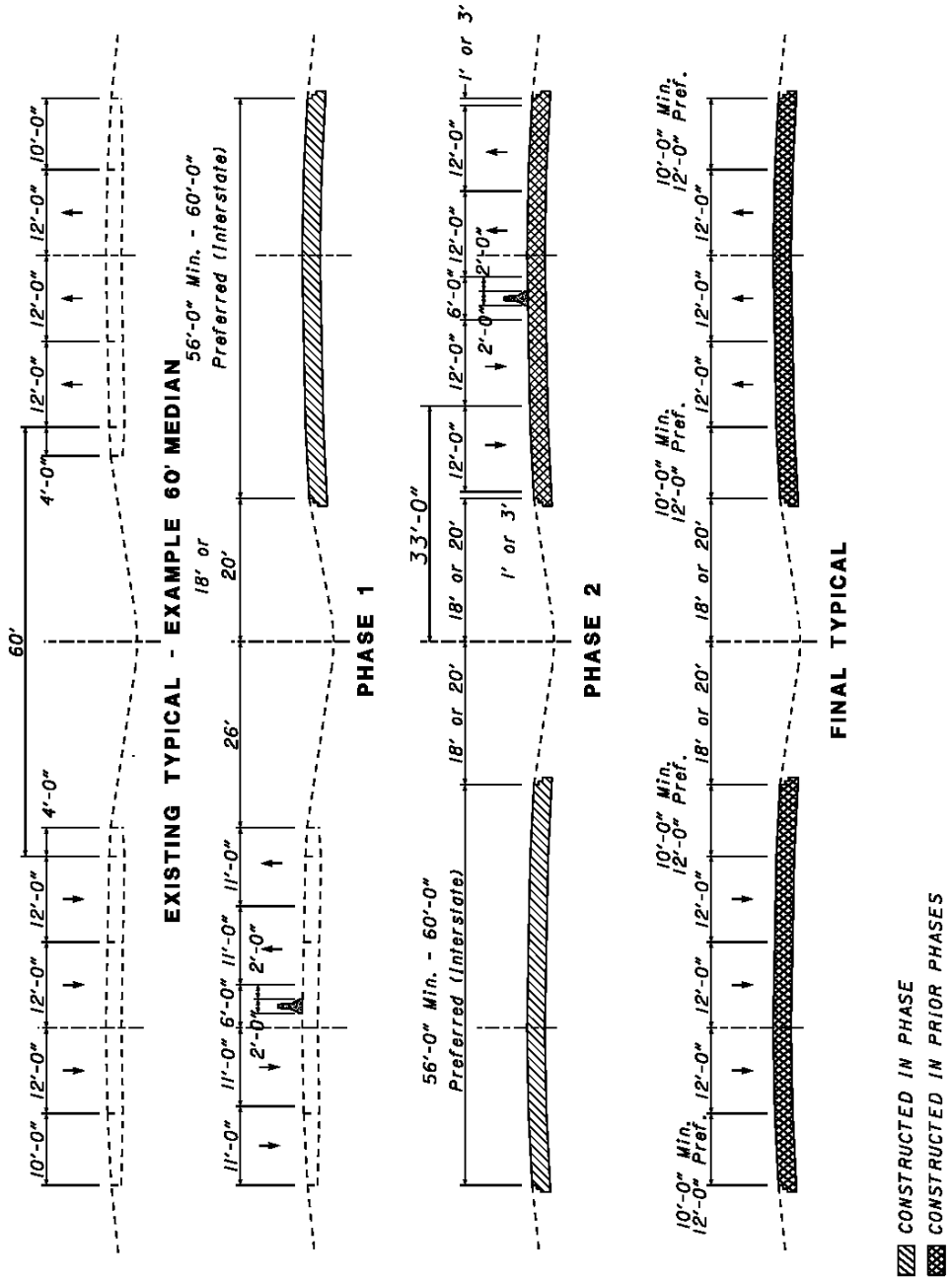



Figure 698-9. Example Typical Sections (Existing 6-Lane Facility)