

# Chapter 17

## Work Zone Management





## Work Zone Management

### 17.1 Introduction

Construction always has some impact on the users of the facility. The various activities required during construction normally cause some disruption to existing pedestrian, bicycle, and motor vehicle patterns. In all but a few instances, the public must have some form of access through or around the work site. The planning, design, and preparation of contract documents for modification of the normal traffic and pedestrian patterns during construction is commonly known as **work zone traffic control**. **Traffic management plans (TMPs)** are the result of this planning and design.

The frequency of crashes in work zones is disproportionately higher than at other locations. Therefore, the primary consideration in work zone traffic control is safety for pedestrians, bicyclists, motorists, and personnel on the worksite. Maintaining the full carrying capacity and accommodation for all users is usually not possible during construction. Existing walkways, bicycle accommodation, and motor vehicle travel lanes are either narrowed, closed, or rerouted. Even when reductions, closures, and rerouting are not necessary, construction activity often reduces quality of service for roadway users because it can be distracting and cause temporary disruptions.

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*For significant projects, a TMP consists of a Temporary Traffic Control (TTC) plan and addresses the Transportation Operations (TO) and the Public Information (PI) aspects of the project.*

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Improving alternative routes of travel, providing temporary facilities, staging work to occur in off-peak hours, and providing police officer control are ways to reduce the impact of construction on roadway operations. These strategies need to be used in such a way as to maintain the safety of facility users and work crews.

This chapter describes some of the basic considerations associated with work zone management. Detailed information on the preparation of traffic management plans is provided in MassHighway's *Standard Details and Drawings for the Development of Traffic Management Plans*, and Part 6,

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*The TO component of the TMP includes the TMP strategies to mitigate the transportation operations and management impacts of the project.*

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Temporary Traffic Control, in the *Manual on Uniform Traffic Control Devices* (MUTCD). A TMP should be prepared for every worksite.

Work zone management influences the accommodation and safety of all users of the facility. The objectives of the management plan should address the following issues:

- The safety of pedestrians, bicyclists, and motorists traveling through the work zone;
- Protection of work crews from hazards associated with moving traffic;
- Capacity of facilities and delays to users;
- Maintenance of access to adjoining properties; and
- Issues that may result in project delay.

## 17.2 Public Information

Accurate and timely reporting of project information is a valuable element in the overall strategy for managing a work zone. The use of resources such as MassHighway's *Project Information System* (ProjectInfo), newspapers, radio, television, changeable message signs, and traveler information systems such as *511*, *MassTraveler*, and *SmarTraveler* (as well as others) can greatly improve the public's acceptance of necessary delays and inconveniences. Key benefits of a public information program are:

- Advance notice might encourage users to seek an alternate route or make alternative arrangements;
- Advance notice might encourage users to travel at off-peak times, or when construction sites are dormant;
- Reduced traffic volumes and increased driver awareness might result in fewer crashes, safer working conditions, and fewer complaints;
- Motorist acceptance might reduce speeding and other aggressive driving behavior in work zones; and
- Advance notice might allow abutters and other impacted parties to ensure that their access needs are considered in the development of a traffic management plan.

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*The PI component of the TMP includes communications strategies to inform road users and the general public about the expected work zone impacts of the project.*

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## 17.3 Coordination

Projects are more successful in managing traffic and providing adequate safety when there is a clear understanding of roles and responsibilities. Coordination is important during both the design and the construction phases. A meeting including the project designer, resident engineer, law enforcement officials, contractor, and community representatives held early in the development of TMPs for major projects can help ensure that work zone management will be effective and that roles and responsibilities are clearly defined.

Early planning efforts should be undertaken to identify whether the population being affected has special access needs. Appropriate efforts should be made to accommodate those needs, especially for the physically disabled. In certain instances, this may require extraordinary measures, such as providing transportation around work areas.

During construction, agreement is necessary between the designer, the resident engineer, the contractor, and local or state police to ensure that traffic management plans and specifications will be effective and are implemented. Close coordination will assure that plans can be refined as needed or modified to effectively address unanticipated situations.

## 17.4 Work Zone Categories

The timing, duration of work, and type of construction operation are major considerations in developing a work zone management plan. The following classifications of work zones can be a helpful framework for addressing these considerations when developing a work zone management plan:

### 17.4.1 Road Closures

Closing a roadway, while not often practical, is often the most efficient arrangement from a construction perspective and can isolate construction from the public, increasing the safety of the operation. For the public, closing a road for a short period may be less of an inconvenience than an extended period of construction activity on an open, restricted road. The designer can consider road closures if an alternate route is available. The alternate route should have sufficient capacity to carry the additional traffic volume and should provide substitute accommodation for pedestrian and bicycle users. In the case

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*For individual projects or classes of projects that have less than significant work zone impacts, the TMP may consist only of a TTC plan.*

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of road closures, it is usually necessary to maintain access to properties fronting the construction zone. If road closure is a reasonable option, the designer should take the following actions before closing a road:

- Obtain local agency approval to use local roads as detours.
- Meet with abutters, businesses, and other community members to discuss the road closure and find ways to mitigate the accessibility impacts.
- Determine the maximum number of days allowed for the closure and incorporate these provisions into the contract documents.
- Determine if additional traffic control or temporary improvements are needed along the detour route.
- Consider how contractor access will be provided to the worksite.
- Contact emergency services, school officials, and transit authorities to determine if there are impacts to their operations.
- Develop a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that divert traffic away from the work zone.

#### **17.4.2 Time Restrictions**

Restricting construction activities to off-peak travel periods is a common management approach for work zones. Some construction and maintenance activities can be conducted at off-peak times, leaving the entire facility usable during peak times. Traffic volumes on highways vary greatly across the time of day and day of the week. Additionally, traffic flows tend to have predominant directions during different periods of the day. Similar temporal distributions are also exhibited by pedestrian and bicycle flows. Exhibit 17-1 indicates that decreased volumes during off-peak hours may allow one or more travel lanes to be closed for roadway work.

If construction activities can be contained within off-peak times, the impacts to roadway users can be reduced. However, construction activities that cause excessive noise, such as pile driving, are usually restricted at night in developed areas. Limitations on noise levels should be considered when considering overnight construction operations. Even

though construction activity is limited to off-peak times, adequate work zone management techniques must be employed during those times.

#### Exhibit 17-1

##### Measured Average Work Zone Capacities

Number of Lanes		Estimated Capacity	
Normally Open	During Construction	Vehicles/hour/lane	Total vehicle/hour
2	1	1,340	1,340
3	2	1,490	2,980
3	1	1,170	1,170
4	3	1,520	4,560
4	2	1,480	2,980
4	1	1,170	1,170

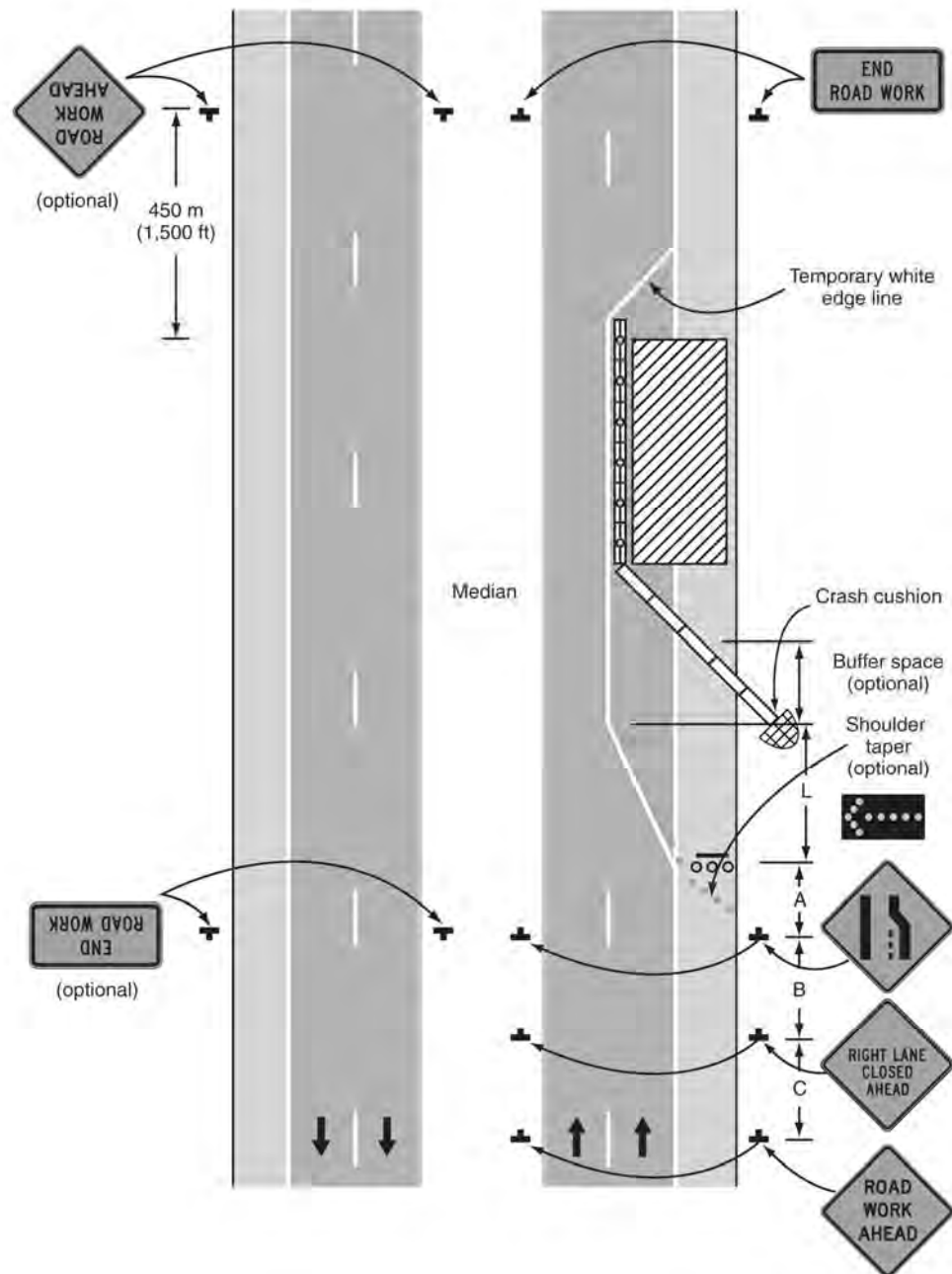
Source: Adapted from Notes on Work Zone Capacity and Level of Service

By comparing hourly traffic volumes (within a minimum of a 48-hour automatic traffic recorder (ATR) count) of the particular roadway to the above estimated capacities, it can be determined at what time of the day or night a certain number of lanes may be closed.

#### 17.4.3 Stationary Work Zones

At long-term stationary work zones there is ample time to install, and benefit from, the full range of traffic control procedures and devices. Generally, larger channelizing devices are used, temporary detours and barriers can be provided, and inappropriate pavement markings can be replaced with temporary markings. The time required for the installation and removal of temporary barriers and markings can be justified when they will be in place for several days. Exhibit 17-2 shows an example of a work zone where a travel lane needs to be closed for an extended period of time. These temporary traffic control plans can be adapted to construction projects on various types of roadways by adjusting the spacing of the warning signs, as shown in Exhibit 17-3.

**Exhibit 17-2**  
**Long Term Stationary Work Zone**



Source: Manual on Uniform Traffic Control Devices, 2003. Part 6 Temporary Traffic Control.



**Exhibit 17-3****Suggested Work Zone Warning Sign Spacing**

Roadway Type	Distance Between Signs (feet)		
	A	B	C
Local Streets	250-350	250-350	350-500
Collectors Streets	250-500	250-500	500
Arterial Roadways	500	1000	1,000-1,140
Freeways/Expressways	1,000	1,500-1,640	2,500-2,780

Note: Distances A, B and C refer to Exhibit 17-2

Source: MassHighway

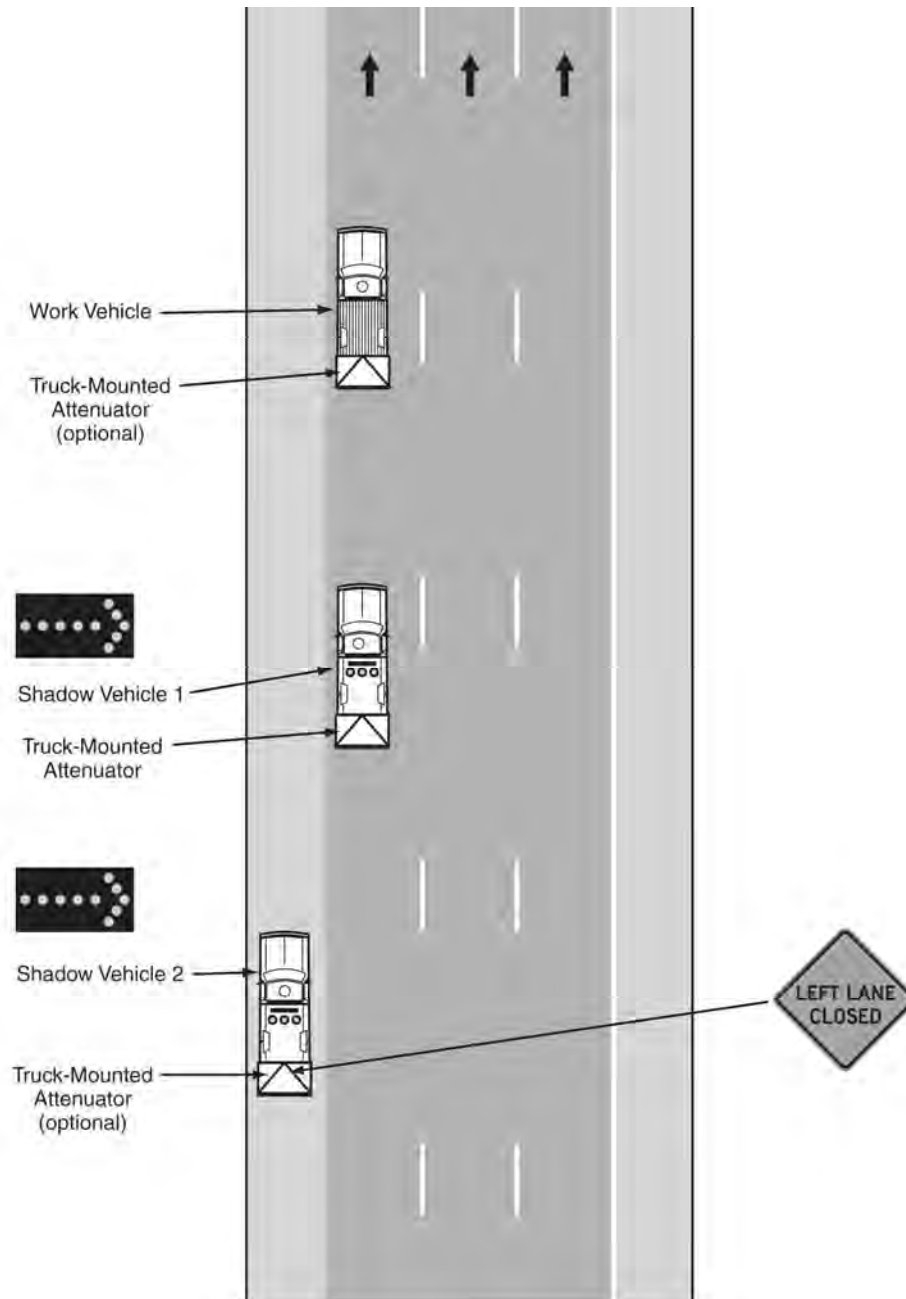
For shorter duration projects, the work crews often set up and break down traffic control devices at the beginning and end of the work cycle, lasting from a few hours to a couple days. Simplified and moveable traffic control procedures are often used for these types of projects.

**17.4.4 Mobile Work Zones**

Mobile work zones are activities that progress along the road either intermittently or continuously. Mobile operations often involve frequent stops for activities such as litter cleanup, pothole patching, or utility operations. Warning signs, flashing vehicle lights, flags, and channelizing devices are often used for these operations.

When the operation moves along the road at low speeds without stopping, the advance warning devices are often attached to mobile units that move with the operation. As indicated in Exhibit 17-4, electronic signs and flashing arrow displays are effective management tools in these situations. Pavement milling and pavement placement, although moving, do not fall into this category and should be treated as stationary work zones.

**Exhibit 17-4**  
**Mobile Work Zone Operation**



Source: Manual on Uniform Traffic Control Devices, 2003. Part 6 Temporary Traffic Control.

## **17.5 Work Zone Safety**

Effective work zone traffic control strategies encompass the safety of all users and workers, and are not limited to providing clear guidance and warning to motorists. Work zone areas present constantly changing roadway conditions that are unexpected by most users. Unless properly managed, these conditions pose a risk to facility users and construction crews.

### **17.5.1 Worker Safety**

Working on highway construction projects is one of the more hazardous work environments in the state. The risk of being struck by a vehicle traveling through a work zone increases with higher traffic volumes and speeds. Long delays can sometimes cause motorists to become impatient and act unpredictably. The designer should consider the risks faced by workers when developing a work zone management plan. In many cases, advisory signs (W13-1) warning motorists to reduce speeds are sufficient and the regulatory speeds (R2-1) are still valid. In areas more sensitive to speed reduction, reduced speed limits can be established. Advisory signs should be used in advance of the reduced speed limit zone to warn motorists of the upcoming change in speed limit. Speed limit and advisory signs should be reinforced with physical measures such as traffic barriers where appropriate.

Traffic barriers protect workers and reduce the need for many other traffic control devices and police presence. The cost of furnishing and removing temporary traffic barriers on long-duration projects can often be less than the cost of periodically relocating other traffic control devices and providing a higher level of police presence. Traffic barriers may also provide greater nighttime visibility of work areas or traffic shifts.

### **17.5.2 Road User Safety**

Road users assume that they have full use of the facility, unless directed otherwise. The message conveyed to the user through signing, markings, and other traffic control devices must be consistent and credible. Considerations for the various roadway user groups are provided in the following sections.

#### **17.5.2.1 Pedestrians**

Pedestrian safety and accessibility are important issues in and around work zones. Pedestrians are susceptible to the impacts of changes in

access, dirt, noise, and fumes in construction areas. Pedestrian routes through construction areas should be maintained. When a pedestrian route is affected by construction, temporary access and detours should be provided to ensure safe, unimpeded travel in and around work zones. Access to bus stops, crosswalks, sidewalks, and other origins and destinations should be maintained. Pedestrians should feel safe and secure when traveling near work zones.

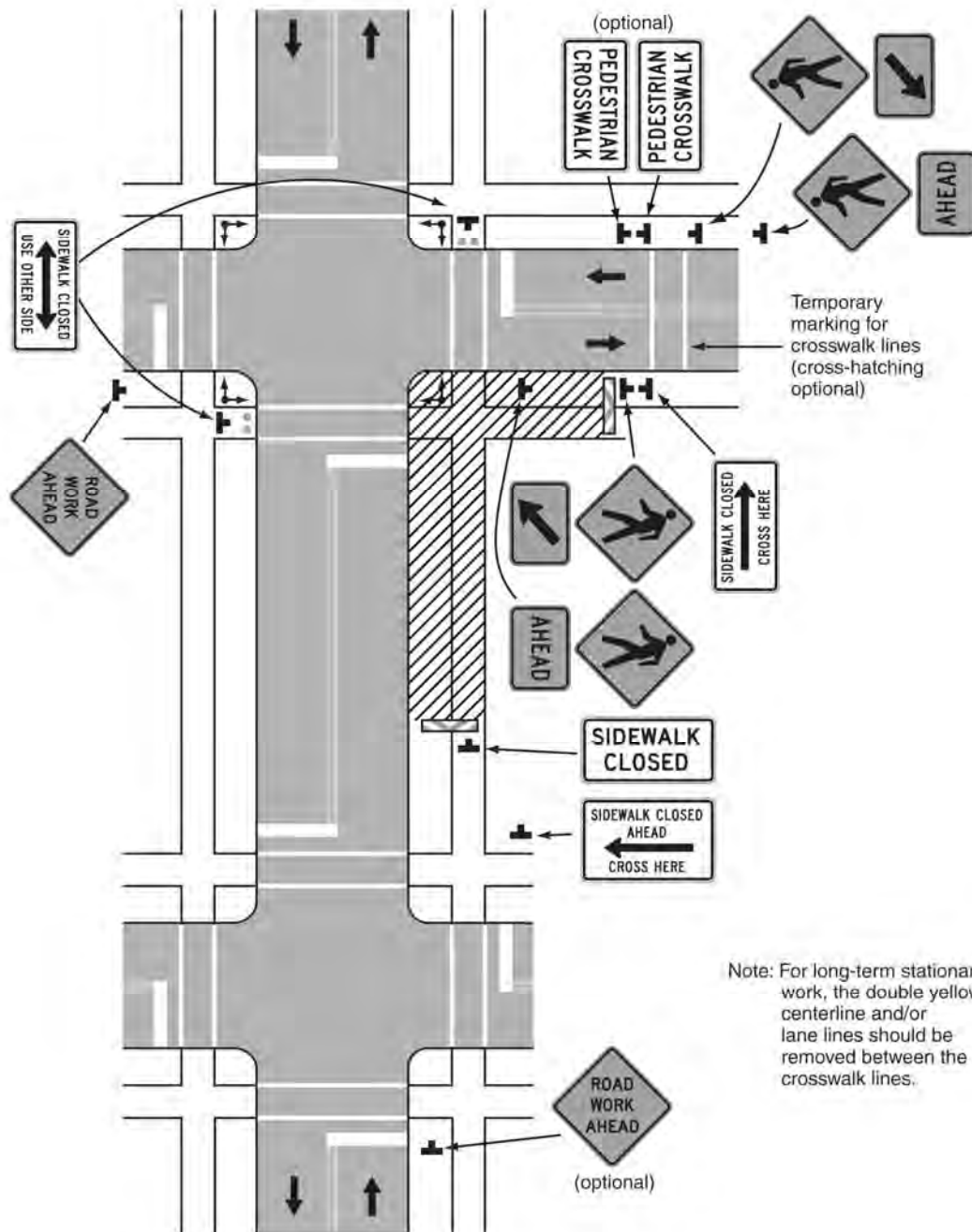
***Pedestrian Routes through Construction Zones***

Proper planning for pedestrians through and along construction areas is as important as planning for vehicle traffic, especially in urban and suburban areas which have the highest volume of pedestrian traffic. Three key considerations for pedestrian safety in work zones are:

- Separate pedestrians from conflicts with construction vehicles, equipment, and operations.
- Separate pedestrians from conflicts with traffic moving through or around the worksite.
- Maintain pedestrian routes with a safe, accessible, and convenient path of travel that duplicates, as nearly as possible, the most desirable characteristics of sidewalks.

When construction requires closing sidewalks, crosswalks, paths and other walkways, a safe, accessible, and convenient alternative route must be maintained. The alternative route preferably should be provided adjacent or close to the existing route. Completely closing a sidewalk for construction and rerouting pedestrians to the other side of the street is another, less desirable option. In the event pedestrians are rerouted to the other side of the street, the street crossing should be located at an intersection, existing crosswalk, or other suitable and safe location, as shown in Exhibit 17-5.

**Exhibit 17-5**  
**Crosswalk Closures and Pedestrian Detours**



Source: Manual on Uniform Traffic Control Devices, 2003. Part 6 Temporary Traffic Control.

If a temporary route is created in the roadway, shoulders, parking lanes, or travel lanes can be converted to temporary walkways using appropriate barricades, reflectorized drums, and signage. Walkways must be clearly identified and fully accessible for people with disabilities, protected from motor vehicle traffic, and free from hazards such as holes, debris, abrupt grade changes, mud, and standing water.

A width of at least 5 feet should be provided. Wider walkways may be necessary where there are high pedestrian volumes. Construction traffic control signs and other equipment should not be placed within the walkway and sidewalks open to pedestrians should not be used as storage areas for construction equipment, workers' vehicles, signs, barricades, or drums. Additionally, signs should not be placed where they block pedestrians using wheelchairs or protrude at head height (between 27" and 80").

At intersections, avoid closing crosswalks but mark temporary crosswalks if necessary. Access to pedestrian push buttons should be maintained, where applicable. Advance signage should be provided at intersections to alert pedestrians of mid-block worksites.

#### ***Protective Barriers***

Barriers to prevent pedestrians from entering construction zones should be continuous and constructed of rigid materials in order to be discerned by pedestrians with vision impairments. The use of "caution" tape or other measures is not acceptable for defining a pedestrian route since these materials are easily broken and do not adequately direct pedestrians into the temporary pathway. Scaffolding and other construction fencing should not have objects that protrude into the clear head space for pedestrians. Temporary work on sidewalks also needs to be barricaded.

At fixed work sites of significant duration, especially in urban areas with high pedestrian volumes, fences may be needed to prevent pedestrian access into the construction site. Where used, fences should be 8 feet high. If chain link fencing is used around an existing sidewalk, signs indicating "Sidewalk Closed/Detour" should be placed at eye height to increase visibility of the fence. Covered walkways and other barriers must be designed to provide ample sight distance at intersections and crosswalks for pedestrians, cyclists, and motorists.

It may be necessary to use a longitudinal traffic barrier to separate the pedestrian from vehicular traffic. The barrier must be of sufficient strength to avoid intrusion by an impacting vehicle. See the *AASHTO Roadside Design Guide* and *NCHRP Report 350* for information on barrier system performance. For work adjacent to high speed traffic, continuous temporary, pre-cast concrete barriers are recommended. Wooden railings, chain link fences, and other similar systems are not suitable for use in this situation.

#### **17.5.2.2 Bicyclists**

Like pedestrians, bicyclists should be accommodated through work zones. If bike accommodation is normally provided on the roadway, the designer should strive to maintain this accommodation through the work zone. In many cases, however, it is not practical to maintain this additional cross-section. When it is not possible to maintain bicycle accommodation, the following should be considered:

- In work areas where the motor vehicle speeds are in the range of 25 to 30 miles per hour, the bicycle can use the same route as the motor vehicles. "Share the Road" signs should be used to alert motorists to the presence of bicycles.
- On higher speed facilities, the designer should attempt to reduce motor vehicle speeds so that they are compatible with shared-lane operations. Reducing the vehicle speeds also improves the safety for pedestrians and crews within the work zone.
- Where appropriate shared use speeds can not be achieved, a different route or detour is desirable. Bicyclists may also be instructed to dismount and walk their bikes through the work zone, following the route provided for pedestrians.
- Loose gravel, abrupt grade changes, milled pavement, standing water, mud, and other hazards create difficulty for bicyclists and should be avoided within the traveled way.
- Raised utility covers and other objects along the edge of the traveled way also pose hazards for cyclists and should be avoided when possible. When these objects are present, they should be marked with reflective paint or other means to improve their visibility.
- Objects protruding from barriers or signs into the bicyclist's head zone pose serious hazards and must be avoided. If construction

requires taking space where bicyclists travel, “Share the Road” signs or alternative routing signs need to be used.

### 17.5.2.3 Motorists

If motorists can easily understand the traffic control and have adequate time to make decisions, they will generally operate their vehicles in a safer manner. As speeds increase, the motorist requires more time to respond to conditions. The details of this relationship are covered in MassHighway’s *Standard Details and Drawings for the Development of Traffic Management Plans*.

Insufficient, conflicting, or too much information conveyed by signage will confuse the motorist and contribute to erratic driving behavior. For example, credibility might be damaged if signing and other devices warn motorists of conditions that do not exist at the time, or provide incorrect directional guidance. Key elements of work zone management plans for motorists include:

- **Speed reduction.** Motorists tend to drive at a speed that seems appropriate for the setting. Imposing an artificially low speed limit is rarely effective, even for work zones. The designer must provide appropriate guidance and transitions from the normal speed condition outside the work zone to a lower-speed environment within the work zone.
- **Enhanced enforcement.** Police details are sometimes present in work zones and reinforce physical measures intended to reduce speeds and moderate driver behavior. In addition to construction zone details, aggressive enforcement of traffic regulations along approaches to and within construction zones can be an effective strategy for reducing motor vehicle speeds and moderating aggressive driving behavior.
- **Temporary Traffic Control (TTC) Plans.** A full complement of barriers, warning signs, pavement markings, and impact attenuators are available for use in different work zone management situations. The following section describes TTC plans in more detail, including the use of various traffic control devices and their placement.

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*In general, speed reduction should not be greater than 10 mph below the posted speed limit. If a greater than 10 mph reduction is required, the speed should be reduced in 5 mph increments. An R2-1 sign should be used to post the reduced speed limit and a W3-5 or W3-5a advisory sign should be used to provide advance warning of the upcoming speed limit change.*

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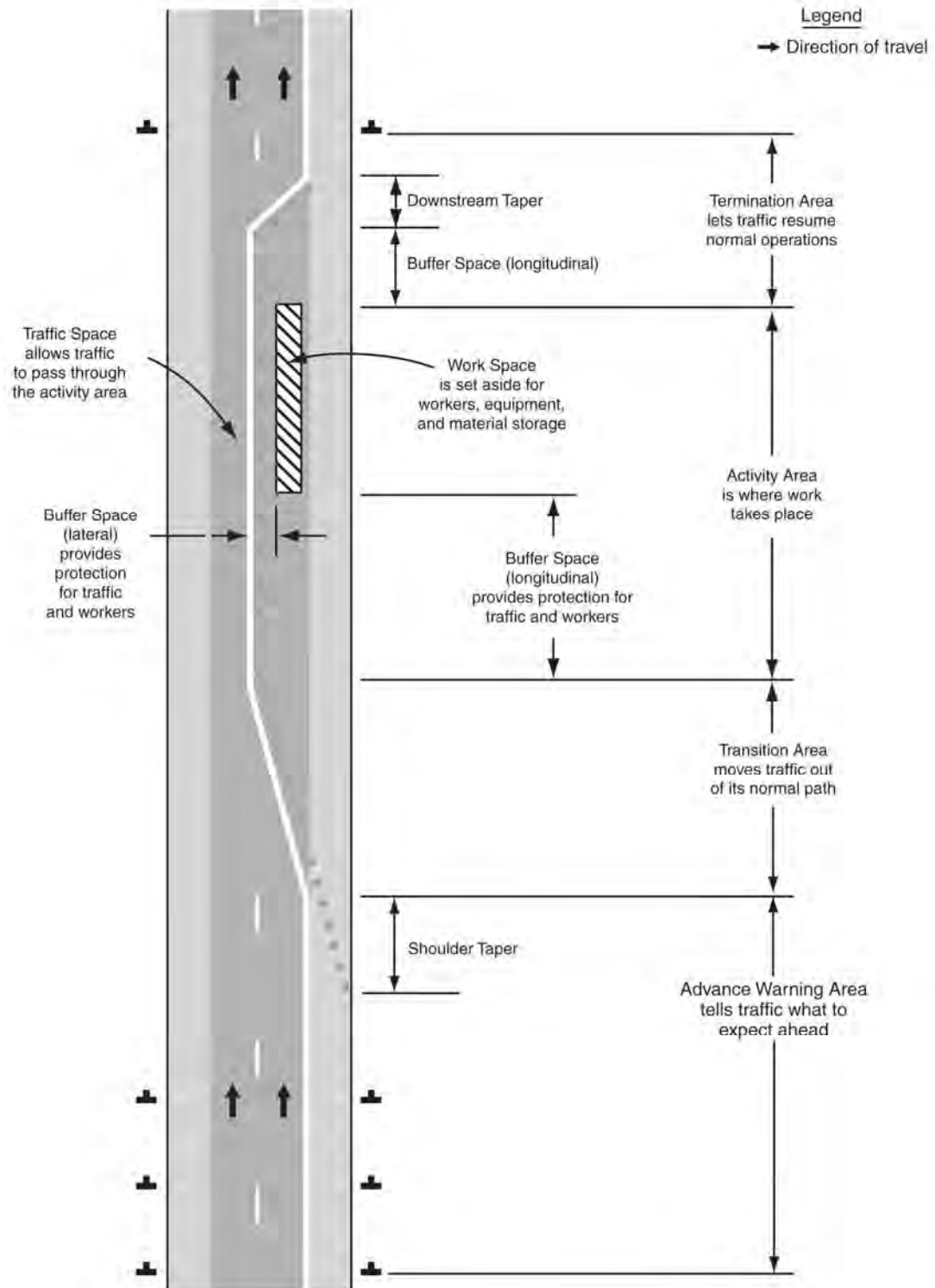
## 17.6 Temporary Traffic Control (TTC) Plans

TTC Plans depict the basic layout of the worksite, the resulting configuration of lanes, and the placement of signage, barriers, and other traffic control devices. Exhibit 17-6 shows the component parts of a TTC Plan. Basic work zone traffic management configurations include:

- Lane narrowing, where the basic number of lanes is maintained;
- Lane closure of one or more lanes;
- Alternating one-way operations for a segment of a two-way roadway with temporary traffic control;
- Use of a temporary bypass constructed within the roadway's right of way;
- Intermittent closure of the roadway for short periods of time;
- Crossover of traffic onto one side of a median, often separated by a temporary barrier;
- Shoulder use for traffic diversion;
- Paved median use for traffic diversion;
- Detour of traffic to alternate routes; and
- Construction between lanes on multilane segment (lane separation).

Procedures, standard drawings and details for these work zone types are included in MassHighway's *Standard Details and Drawings for the Development of Traffic Management Plans*. Additional information on Work Zone Management can be found in the *Manual on Uniform Traffic Control Devices*.

**Exhibit 17-6**  
**Component Parts of A Temporary Traffic Control Zone**



Source: Manual on Uniform Traffic Control Devices, 2003. Part 6 Temporary Traffic Control.

## 17.7 For Further Information

- *Standard Details and Drawings for the Development of Traffic Management Plans*, MassHighway, 2005.
- *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2004.
- *Guide for the Planning and Design of Pedestrian Facilities*, AASHTO, 2004.
- *Manual on Uniform Traffic Control Devices*, Federal Highway Administration, 2003.
- *Pedestrian Facilities Guidebook: Incorporating Pedestrians into Washington's Transportation System*, Washington State Department of Transportation, Puget Sound Regional Council, County Road Administration Board, Washington Association of Cities, 1997.
- *Design Manual*, Washington State Department of Transportation, 2004.
- *Accessible Rights of Way: A Design Guide*, Architectural and Transportation Barriers Compliance Board, 1999.
- *DRAFT ADA Accessibility Guidelines for Public Rights of Way*, Architectural and Transportation Barriers Compliance Board, Washington, D.C., 2002.
- *521 CMR: The Rules and Regulations of the Massachusetts Architectural Access Board*, Boston, MA., 2002.
- *ADA Accessibility Guidelines for Buildings and Facilities (ADAAG)*, U.S. Department of Justice, Washington, D.C., 1992.
- *National Cooperative Highway Research Program Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features, Part A and Part B*, NCHRP Project 22-07.
- *Notes on Work Zone Capacity and Level of Service*, Texas Transportation Institute, Texas A&M University, 1984
- *23 CFR Part 630, subpart J: Work Zone Safety and Mobility*, Washington DC, 2004.