

# Federal Highway Administration University Course on Bicycle and Pedestrian Transportation

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## Lesson 21: Bicycle and Pedestrian Accommodation in Work Zones

July 2006



U.S. Department of Transportation  
**Federal Highway Administration**



Pedestrian and Bicycle Safety

# SI\* (MODERN METRIC) CONVERSION FACTORS

## APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
<b>LENGTH</b>				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
<b>AREA</b>				
in <sup>2</sup>	square inches	645.2	square millimeters	mm <sup>2</sup>
ft <sup>2</sup>	square feet	0.093	square meters	m <sup>2</sup>
yd <sup>2</sup>	square yard	0.836	square meters	m <sup>2</sup>
ac	acres	0.405	hectares	ha
mi <sup>2</sup>	square miles	2.59	square kilometers	km <sup>2</sup>
<b>VOLUME</b>				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft <sup>3</sup>	cubic feet	0.028	cubic meters	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.765	cubic meters	m <sup>3</sup>
NOTE: volumes greater than 1000 L shall be shown in m <sup>3</sup>				
<b>MASS</b>				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
<b>TEMPERATURE (exact degrees)</b>				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
<b>ILLUMINATION</b>				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m <sup>2</sup>	cd/m <sup>2</sup>
<b>FORCE and PRESSURE or STRESS</b>				
lbf	poundforce	4.45	newtons	N
lbf/in <sup>2</sup>	poundforce per square inch	6.89	kilopascals	kPa

## APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
<b>LENGTH</b>				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
<b>AREA</b>				
mm <sup>2</sup>	square millimeters	0.0016	square inches	in <sup>2</sup>
m <sup>2</sup>	square meters	10.764	square feet	ft <sup>2</sup>
m <sup>2</sup>	square meters	1.195	square yards	yd <sup>2</sup>
ha	hectares	2.47	acres	ac
km <sup>2</sup>	square kilometers	0.386	square miles	mi <sup>2</sup>
<b>VOLUME</b>				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m <sup>3</sup>	cubic meters	35.314	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.307	cubic yards	yd <sup>3</sup>
<b>MASS</b>				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
<b>TEMPERATURE (exact degrees)</b>				
°C	Celsius	1.8C+32	Fahrenheit	°F
<b>ILLUMINATION</b>				
lx	lux	0.0929	foot-candles	fc
cd/m <sup>2</sup>	candela/m <sup>2</sup>	0.2919	foot-Lamberts	fl
<b>FORCE and PRESSURE or STRESS</b>				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in <sup>2</sup>

\*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.  
(Revised March 2003)

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# LESSON 21:

## BICYCLE AND PEDESTRIAN ACCOMMODATION IN WORK ZONES

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### 21.1 Introduction

When construction zones encroach on sidewalks or crosswalks, pedestrians may suddenly find they have to make detours that are unsafe, difficult to navigate, or both (see figure 21-1). They may be forced to choose between picking their way through the construction site or walking in a busy street. Projects that are built in phases and construction zones that change weekly or even daily only add to the problem.

Bicyclists also experience difficulties when traveling through construction zones, particularly when roadway space is constrained and pavement conditions are rough. In some instances, sudden pavement changes in construction zones can represent a severe hazard to bicyclists. In all such cases, it is important to ensure that bicycle and pedestrian detour routes are accessible and signed for all users.



**Figure 21-1. Photo. Utility work in bike lanes can often be accomplished without blocking the entire lane.**

This lesson describes typical problems and solutions that improve conditions for bicyclists and pedestrians in work zones. The major sections of this lesson are as follows:

- 21.1 Introduction.
- 21.2 Possible Solutions.
- 21.3 Implementation Strategies.
- 21.4 Planning and Design Considerations.
- 21.5 Student Exercise.
- 21.6 References and Additional Resources.

## 21.2 Possible Solutions

It is important to develop and implement construction zone policies to eliminate unexpected obstacles for pedestrians and bicyclists and make transitions as safe and smooth as possible. The following concerns should be addressed:

- Advance warning and guidance signs.
- Adequate illumination and use of retroreflective materials.
- Channelizing and barricading to separate pedestrians from traffic.
- Temporary curb ramps and pedestrian signals where appropriate.
- Measures preventing visually impaired pedestrians from entering work zones.
- Warnings to bicyclists about surface irregularities and maintenance of areas where bicyclists can pass through construction zones.
- Circumstances requiring temporary walkways and/or bikeways.

Contractors should be allowed flexibility as long as requirements are met. Because many traffic control decisions are made daily in the field, it is often difficult to plan ahead. All parties involved should be made aware of the needs of pedestrians and bicyclists and be made responsible for ensuring safe and continuous passage. Many agencies require contractors to maintain access on the same side of the street.

### *Protective Barriers*

According to the “Safety in Work Zones” chapter of the Georgia Department of Transportation (GDOT) publication, *Pedestrian and Streetscape Guide*:<sup>(1)</sup>

Near work zones where higher volumes of pedestrian traffic or school children exist, pedestrian fences or other protective barriers may be needed to prevent pedestrian access into a construction area. Barriers should be made of sturdy, non-bendable material such as wood. Pedestrian fences should be at least 2.4 [meters] m (8 [feet] ft) high to discourage pedestrians from climbing over the fence and should be (cane) detectable by vision impaired.

The 2003 *Manual on Uniform Traffic Control Devices* (MUTCD) provides the following standard relating to protective barriers:<sup>(2)</sup>

Short intermittent segments of temporary traffic barrier shall not be used because they nullify the containment and redirective capabilities of the temporary traffic barrier, increase the potential for serious injury both to vehicle occupants and pedestrians, and encourage the presence of blunt, leading ends. All upstream leading ends that are present shall be appropriately flared or protected with properly installed and maintained crashworthy cushions. Adjacent temporary traffic barrier segments shall be properly connected in order to provide the overall strength required for the temporary traffic barrier to perform properly.

## *Covered Walkways*

The GDOT *Pedestrian and Streetscape Guide* also states:<sup>(1)</sup>

For construction of structures adjacent to sidewalks, a covered walkway may be required to protect pedestrians from falling debris. Covered walkways should be designed to provide:

- Sturdiness.
- Accessible for all users.
- Adequate light and visibility for nighttime use and safety.
- Proper sight distance at intersections and crosswalks.
- Adequate and impact-resistant longitudinal separation from vehicles on higher speed streets; for work zones adjacent to high speed traffic, wooden railings, chain link fencing, and other similar systems are not acceptable.

The MUTCD standard provides that “temporary traffic control devices used to delineate a temporary traffic control zone pedestrian walkway shall be crashworthy and, when struck by vehicles, present a minimum threat to pedestrians, workers, and occupants of impacting vehicles.”<sup>(2)</sup>

## *Sidewalk Closures*

The “Safety in Work Zones” chapter of the GDOT *Pedestrian and Streetscape Guide* provides this information about sidewalk closures:<sup>(1)</sup>

It is undesirable to close sidewalks or pathways during construction. This should be the last option. If sidewalks have to be closed, construction sites should provide alternative pedestrian routes, safe crossings to the other side of the street, and easy-to-read and distinguishable signs and placement markings. Temporary walkways must also be safe and clear of obstructions such as debris, potholes, grade changes, and mud. If a temporary route is created in the roadway adjacent to the closed sidewalk, the parking lane or one travel lane in a multilane street may be used for pedestrian travel, with appropriate barricades, cones, and signing, as illustrated in [f]igure 21-2. When using a barricade, it must be a continuous route, detectable by a cane. When a parking lane or travel lane is not available for closure, pedestrians must be detoured with advance signing in accordance with the *Manual on Uniform Traffic Control Devices*. For midblock construction, signs should be placed at the nearest intersection to forewarn pedestrians of a sidewalk closure. Signs should also be placed to avoid blocking the path of pedestrians.

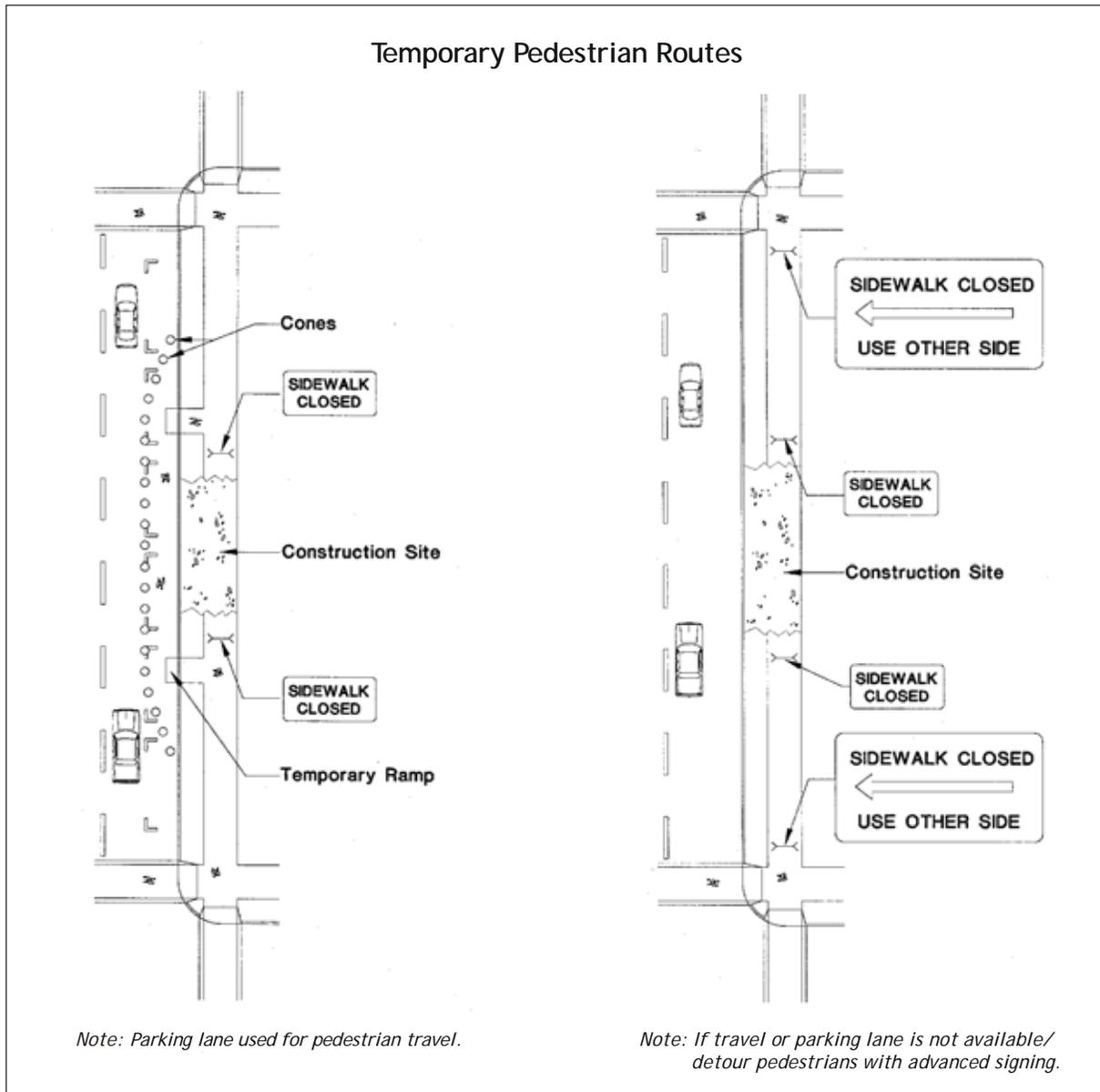
If sidewalks are closed and an alternate route has been determined, chapter 6D of MUTCD provides the following guidance for planning for pedestrians in temporary traffic control zones:<sup>(2)</sup>

1. Pedestrians should not be led into conflicts with work site vehicles, equipment, and operations.
2. Pedestrians should not be led into conflicts with vehicles moving through or around the work site.
3. Pedestrians should be provided with a safe, convenient path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or a footpath(s).

Avoid closing the crosswalks at intersections. Also, at signalized intersections:<sup>(1)</sup>

- Mark temporary crosswalks if they are relocated from their previous location.

- Maintain access to pedestrian pushbuttons.
- Include pedestrian phases in temporary signals.
- Place advanced signing at intersections to alert pedestrians of midblock work sites and direct them to alternate routes (consider all users).



**Figure 21-2. Illustration. Example method to create passageways for pedestrians during construction.**

Source: *Pedestrian and Streetscape Guide*<sup>(1)</sup>

## *Signage*

Advance signage should be provided that will alert pedestrians to potential sidewalk closures, diversions, or detours. Where pedestrians with vision disabilities normally use the closed sidewalk, a barrier that is detectable by a person aided by a long cane shall be placed across the full width of a closed sidewalk.<sup>(2)</sup>

Adequate provisions should be made for persons with disabilities as determined by an engineering study or by engineering judgment. Because printed signs and surface delineation are not usable by pedestrians with visual disabilities, blocked routes, alternate crossings, and sign and signal information should be communicated to such pedestrians with audible information devices, accessible pedestrian signals, and barriers and channelizing devices that are detectable to pedestrians who are aided by a long cane or have low vision.<sup>(2)</sup>

The most desirable way to provide visually disabled pedestrians with information that is equivalent to visual signage for notification of sidewalk closures is a speech message provided by an audible information device. Devices that provide speech messages in response to passive pedestrian actuation are the most desirable. Other devices that continuously emit a message or that emit a message in response to use of a pushbutton are also acceptable. Signage information can also be transmitted to personal receivers, but currently such receivers are not likely to be carried or used by pedestrians with visual disabilities in temporary traffic control zones. Audible information devices might not be needed if detectable channelizing devices make an alternate route of travel evident to pedestrians with visual disabilities.

## *Diversions and Detours*

The following standards and guidance are from the 2003 edition of the MUTCD:<sup>(2)</sup>

When existing pedestrian facilities are disrupted, closed, or relocated in a temporary traffic control zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility.

To accommodate the needs of pedestrians, including those with disabilities, the following considerations should be addressed when temporary pedestrian pathways in temporary traffic control zones are designed or modified:

- Provisions for continuity of accessible paths for pedestrians should be incorporated into the temporary traffic control process. Pedestrians should be provided with a reasonably safe, convenient, and accessible path that replicates as much as practical the desirable characteristics of the existing pedestrian facilities.
- Access to temporary transit stops should be provided.
- Blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing devices such as audible information devices, accessible pedestrian signals, or barriers and channelizing devices that are detectable to the pedestrians traveling with the aid of a long cane or who have low vision. Where pedestrian traffic is detoured to a temporary traffic control signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals should be considered for crossings along an alternate route.

- When channelizing is used to delineate a pedestrian pathway, a continuous detectable edging should be provided throughout the length of the facility such that pedestrians using a long cane can follow it.
- A smooth, continuous hard surface should be provided throughout the entire length of the temporary pedestrian facility. There should be no curbs or abrupt changes in grade or terrain that could cause tripping or be a barrier to wheelchair use. The geometry and alignment of the facility should meet the applicable requirements of the “Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)” (see [s]ection 1A.11).
- The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 1500 [millimeters] mm (60 [inches] in[.]) throughout the entire length of the pedestrian pathway, a 1500 by 1500 mm (60 [by] 60 [inches] in.) passing space should be provided at least every 60 m (200 ft), to allow individuals in wheelchairs to pass.
- Signs and other devices mounted lower than 2.1m (7 ft) above the temporary pedestrian pathway should not project more than 100 mm (4 inches) into accessible pedestrian facilities.

See figure 21-3 for an example of a crosswalk closure and pedestrian detour.

### 21.3 Implementation Strategies

Developing a workable policy for bicycle and pedestrian access through construction zones requires the cooperation of traffic engineers, construction inspectors, crew chiefs, contractors, and advocates. The policy should apply whenever construction or maintenance work affects pedestrian or bicycle access, whether the work is done by private firms or city, county, or State crews.

#### *Link to Construction Permits*

To develop the above policy, permits required for street construction or construction projects that encroach upon sidewalks or crosswalks should be contingent upon meeting bicycle and pedestrian access policies. Contractors should be given copies of the standards when they apply for a permit. Preexisting standards or a policy that is readily available will prove useful for incorporation into contracts, agreements, or specifications.

#### *Train In-House Work Crews*

Many road, pavement, maintenance, or utility projects use permanent city crews to do the work. Crew chiefs and crews should be educated to ensure that they understand and follow the policy.

Enacting pedestrian and bicycle access policies for work zones are not expensive. The main costs involve developing the policy, training crews and construction inspectors, and imparting information to contractors. Ongoing costs will involve work site inspection.

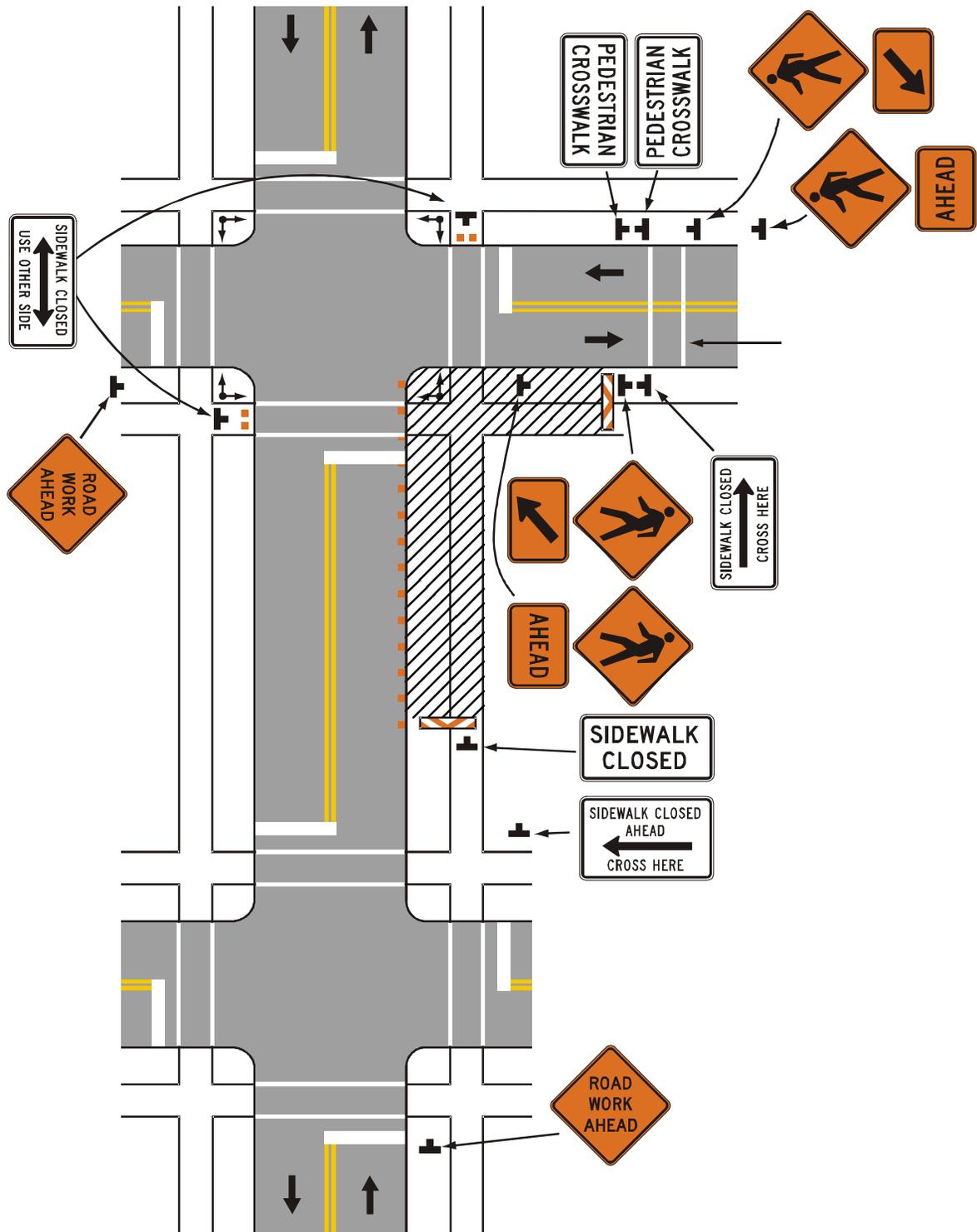


Figure 21-3. Illustration. Sidewalk closure and pedestrian detour example.

Source: MUTCD<sup>(2)</sup>

## 21.4 Planning and Design Considerations

While the 2003 MUTCD pedestrian guidelines apply to pedestrian traffic around work zones, the absence of specific guidance on pedestrian access around construction zones leaves local agencies with a great deal of flexibility. Keep in mind that MUTCD silence on this subject may lead some in an agency to balk at establishing hard and fast regulations.

### *Rural Highway Construction*

Construction operations on rural highways affect mostly touring and recreational bicyclists; pedestrians are seldom encountered in rural settings.

On low-volume roads or through short construction zones, standard traffic control practices are usually adequate. Bicyclists can ride through without impeding traffic. Their needs can be met by maintaining a paved surface and removing temporary signs, debris, and other obstructions from the edge of the roadway after each day's work.

On high-volume roads or through long construction zones, enough paved roadway width should be provided for motor vehicles to safely pass bicyclists. Flaggers and pilot cars should take into account the bicyclists' lower speeds. When bicyclists are coming through, radio messages can be relayed to other flaggers.

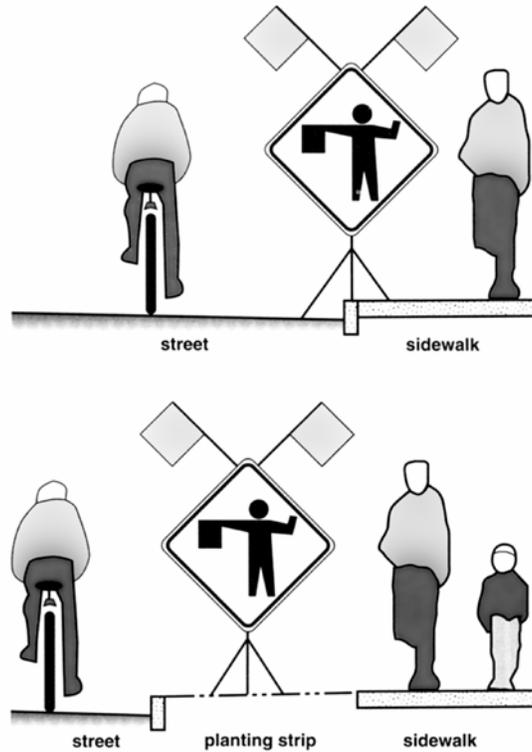
On highways with very high traffic volumes and speeds, and where construction will restrict available width for a long time, it may be advisable to provide a detour route for bicyclists where possible. The detour should not be overly circuitous. Directional signs should guide bicyclists along the route and back onto the highway.

### *Urban Roadway Construction*

Through-bicycle movement must also be maintained. Bicyclists can share a lane over a short distance. On longer projects and on busy roadways, a temporary bike lane or wide outside lane may be provided. Bicyclists should not be routed onto sidewalks or onto unpaved shoulders.

Debris should be swept to maintain a reasonably clean riding surface in the outer 1.5 or 1.8 m (5 or 6 ft) of roadway. Bicyclists have a low tolerance for surface grade changes and excessive bumps should be avoided.

The placement of advance construction signs should obstruct neither the pedestrian's nor the bicyclist's path (see figure 21-4). Where this is not possible, placing signs half on the sidewalk and half on the roadway may be the best solution.



**Figure 21-4. Illustration. Construction sign placement.**

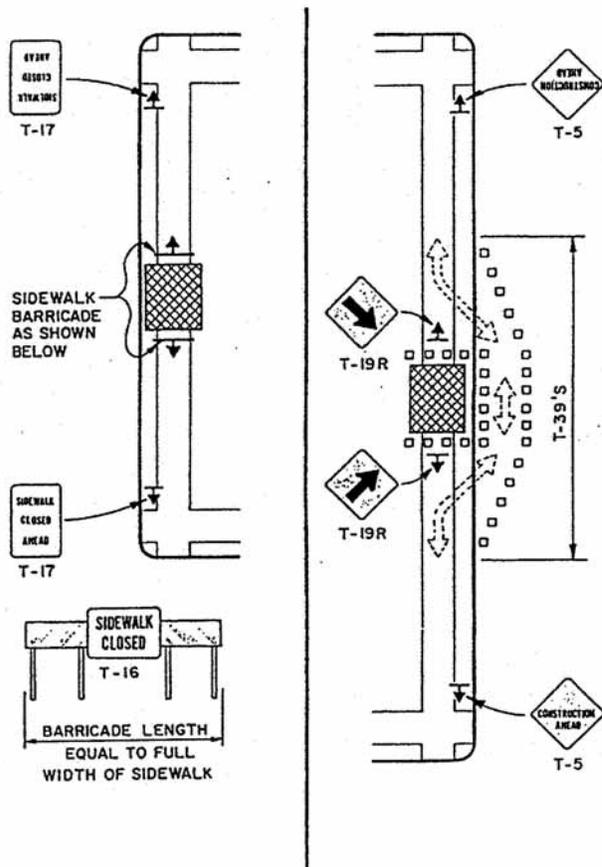
*Pedestrian Issues: Seattle Example*

The City of Seattle has developed specific policies for pedestrian access, control, and protection in work zones. These policies are detailed in the City’s *Traffic Control Manual for In-Street Work*.<sup>(3)</sup> The purpose of the manual is “to set forth the basic principles and standards to be observed by all those who perform work in public streets so as to provide safe and effective work areas and to warn, control, protect, and expedite vehicular and pedestrian traffic.”

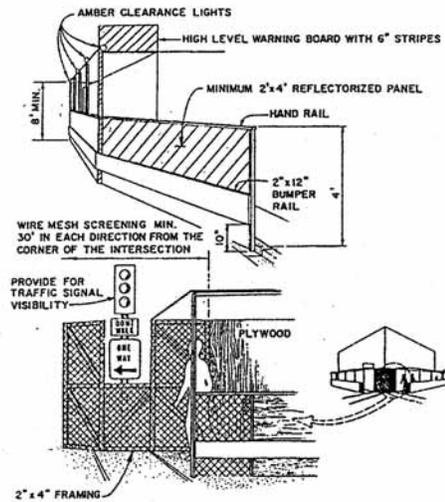
Before any in-street work is started, all persons performing work within the street right-of-way must first obtain a permit by submitting and receiving approval of a traffic control plan.

To protect pedestrians, the manual describes procedures for erecting protective barricades, fencing, and bridges, together with guidance devices and signs. Whenever passageways or walkways are affected by construction, access for pedestrians and disabled persons is ensured. Access to recommended school crossings must be maintained at all times. Where walkways are necessarily closed by construction, alternate walkways, including temporary curb ramps, must be provided. Where alternate walkways are not feasible, signs are required at the limits of construction and in advance of the closure at the nearest crosswalk or intersection to divert pedestrians across the street. Pedestrians must never be diverted into a portion of the street concurrently used by moving vehicular traffic. Where required, fixed pedestrian ways using fences and canopies shall be considered. Adequate illumination and use of retroreflective materials are required during hours of darkness.

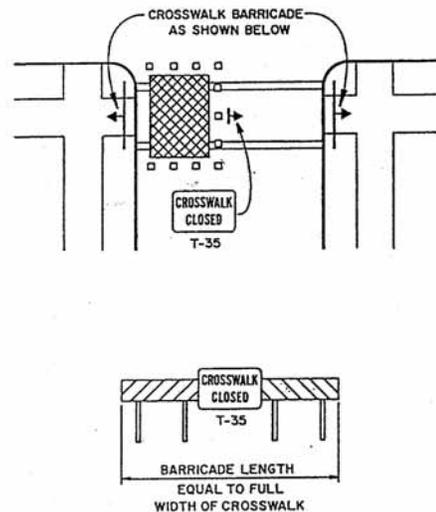
Figures 21-5 and 21-6 are excerpted from Seattle’s *Traffic Control Manual for In-Street Work*.<sup>(3)</sup>



**Figure 21-5. Illustration. Pedestrian control .**  
 Source: *Traffic Control Manual for In-Street Work*<sup>(3)</sup>



**PEDESTRIAN PROTECTION**



**Figure 21-6. Illustration. Pedestrian control.**

Source: *Traffic Control Manual for In-Street Work*<sup>(3)</sup>

### 21.5 Student Exercise

Identify several work zone locations and determine what elements of accommodation are being made. Are there others that could be made or might be more appropriate? Survey the location for several hours during the peak traffic period and determine if pedestrians are using the facilities in place. Do they violate the channelization? Why do they violate it, and are they endangering themselves? What can be done to improve the situation?

## 21.6 References and Additional Resources

The references for this lesson are:

1. “Toolkit 11: Safety in Work Zones,” *Pedestrian and Streetscape Guide*, Georgia Department of Transportation, Atlanta, GA, November 2003, available online at [http://www.dot.state.ga.us/DOT/plan-prog/planning/projects/bicycle/ped\\_facilities\\_guide/index.shtml](http://www.dot.state.ga.us/DOT/plan-prog/planning/projects/bicycle/ped_facilities_guide/index.shtml), accessed April 23, 2004.
2. *Manual on Uniform Traffic Control Devices for Streets and Highways*, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, 2003, available online at <http://mutcd.fhwa.dot.gov>, accessed March 21, 2003.
3. *Traffic Control Manual for In-Street Work*, Fourth Edition, Seattle Department of Transportation, Seattle, WA, 1994, available online at <http://www.seattle.gov/transportation/trafficcontrolmanual.htm>.

Additional resources for this lesson include:

- *Oregon Bicycle and Pedestrian Plan*, Oregon Department of Transportation, Salem, OR, 1995.
- *Implementing Pedestrian Improvements at the Local Level*, U.S. Department of Transportation, Federal Highway Administration, Publication No. FHWA-98-138, Washington DC, 1998, Available online at <http://safety.fhwa.dot.gov/fourthlevel/pdf/LocalPedGuide.pdf>, accessed March 9, 2004.

