

Practices and Needs in Work Zone Pedestrian Safety

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Practices in controlling and protecting pedestrians in work zones are investigated in this paper. The information presented is based on research conducted in the development of the report *Work Zone Traffic Management Synthesis: Work Zone Pedestrian Protection (1)*. The findings and recommendations are based on interviews, literature review, and field observations of highway, building construction, and maintenance projects in several cities. Good practice in protecting pedestrians in work zones is sporadic. Many cities, including high population centers, have no documented and comprehensive pedestrian safety standards for contractors to follow. Improvement of Part VI of the *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) (2)*, to include information on how to accommodate and protect pedestrians in work sites, has the greatest potential for promoting good practice. Ideas for such improvement are presented.

Work zones located in areas with pedestrian traffic can jeopardize the safety of workers and pedestrians. Although much progress has been accomplished to date on work zone safety, the safe accommodation of pedestrians in work areas is frequently neglected by the construction and traffic safety communities. The right of pedestrians to safe passage is an important issue that must be considered in planning, design, and implementation of traffic control for work areas.

BACKGROUND

Pedestrian Right to Safe Pathways

Since 1981, the continuing neglect of pedestrian safety in work zones has been the subject of research papers (3–6) based on the efforts of the Federal Highway Administration (7) to better understand the issue. These papers (3–5) present photographic evidence of the neglectful treatment of pedestrians in urban work zones. Recent field observations (1) in the downtown areas of several major cities: Albany, Baltimore, Chicago, New York, Philadelphia, Richmond, San Francisco, Seattle, and Washington, D.C., clearly indicate that pedestrian safety is not a priority item in urban work zones. The abuse of pedestrian pathways during roadway rehabilitation and maintenance, building demolition and construction, and diverse utility operations in downtown areas reflects a continuing unawareness of pedestrian rights. The rights of pedestrians to access properties abutting work areas and to enjoy safe passage through and around construction projects is of

no less importance than the right of safe passage accorded to motorists.

Pedestrian Protection Standards

At present, there is no comprehensive national standard on pedestrian accommodation in work areas. Part VI of the *Manual On Uniform Traffic Control Devices (MUTCD) (2)* is held in high regard for its coverage of traffic control principles and devices for vehicular traffic in work areas, but it is grossly deficient in pedestrian protection material. Some states and localities rely on the fundamental principles presented in the *Traffic Control Devices Handbook (TCDH) (8)*. However, the TCDH is not regarded as a standard nor as having any legal significance, and thus its principles have not been widely adopted into state manuals. TCDH provides the following guidelines on pedestrian control in highway work zones:

1. Pedestrians and vehicles should be physically separated (i.e., by barriers, barricades, or similar items).
2. Pedestrian walkways should be maintained free of any obstructions and hazards such as holes, debris, mud, construction equipment, stored materials, and so on).
3. Temporary lighting should be considered for all walkways that are used at night, particularly if adjacent walkways are lighted.
4. Walkways should be at least 4 or 5 feet wide, and should be wider in areas of high pedestrian activity.
5. All hazards (ditches, trenches, excavations, etc.) near or adjacent to walkways should be clearly delineated.
6. Walkways under or adjacent to elevated work activities such as bridges or retaining walls may require a protective roof.
7. Where safe pedestrian passage can not be provided, pedestrians should be directed to the other side of the street by appropriate traffic control devices.
8. Signs and traffic control devices should not be a hazard to pedestrians.
9. Signs located near or adjacent to a sidewalk should have a 7-ft clearance.
10. Where construction activities involve sidewalks on both sides of the street, efforts should be made to stage the work so that both sidewalks are not out of service at the same time.
11. In the event that sidewalks on both sides of the street are closed, pedestrians should be guided around the construction site.
12. Reflectorized traffic control devices are of little value to pedestrians. Warning lights should be used to delineate the pedestrians' pathway and to mark hazards as appropriate.

The two methods included in the TCDH for controlling pedestrians during mid-block sidewalk closure are shown in Figure 1. It should be noted that no typical pedestrian information signs are presented in the bypass illustration.

Large cities and counties traditionally rely on the limited provisions of state and local building codes for pedestrian traffic control in downtown work zones. For example, a permit is required for any excavation in the street or sidewalk in the city and county of San Francisco. The street excavation provisions of San Francisco (9) stipulate that contractors must provide and maintain safe and adequate passage of pedestrians and vehicles over and adjacent to excavations. However, these provisions seldom include procedural guidelines for the selection and placement of pedestrian protection devices in work zones that are not related to utility and building construction. In spite of its deficiency, the building permit review process is regarded by city officials as the primary opportunity to determine the adequacy of proposed pedestrian management systems for urban construction projects.

Current use of pedestrian canopies and fencing are the result of progressive building codes and, to some extent, to the special efforts of contractors and developers as they attempt to minimize their tort liability.

LITERATURE REVIEW

Pedestrian Information Needs

Pedestrians need information to enable them to recognize work areas and potential hazards and to guide them safely through and around work zones. Sometimes the mere use of work area delineation devices is sufficient to alert pedestrians to the potential danger. In complex situations in which pedestrians are required to use bypasses and detours, a special effort must be made to provide positive guidance.

Research publications on methods for accommodating pedestrians in work zones are scarce. Except for a Federal High-

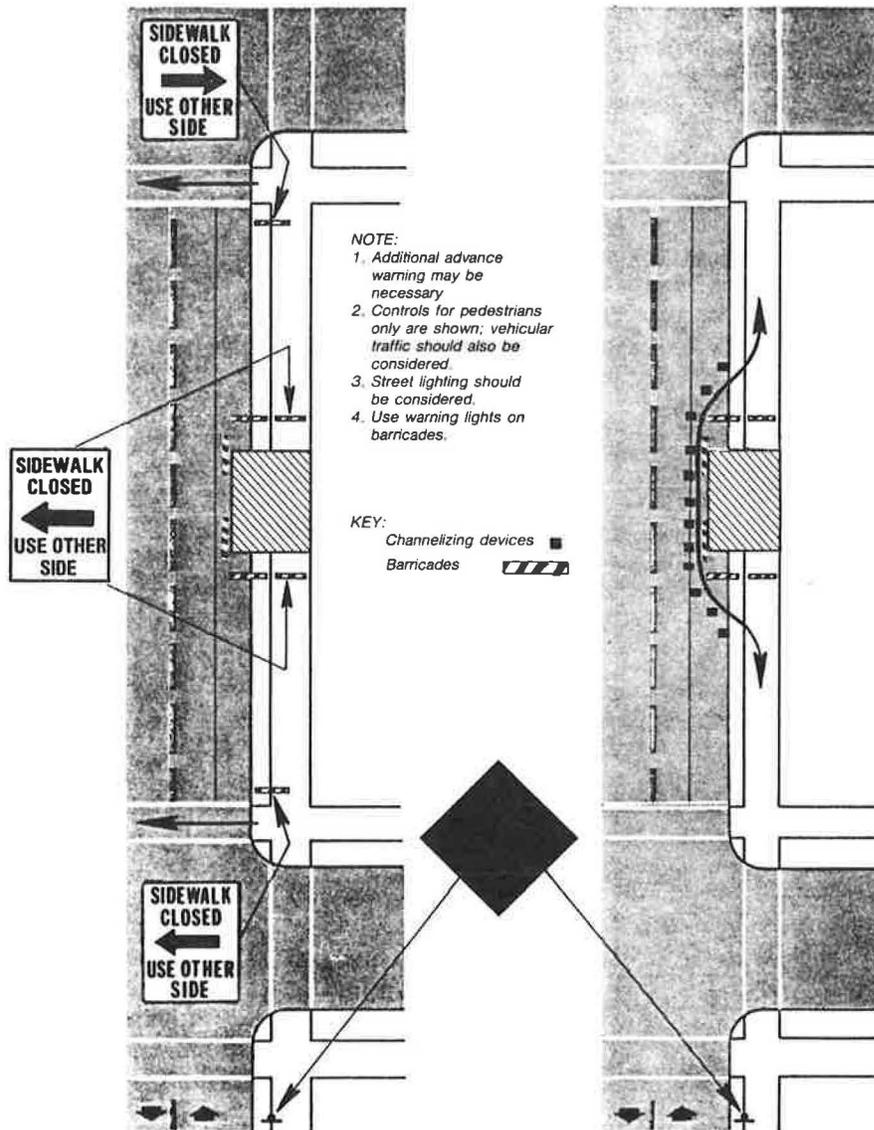


FIGURE 1 Pedestrian control for mid-block sidewalk closure (2).

way Administration study (7), which formed the basis for several publications by Chadda et al. (3-6), the subject of pedestrian safety in work zones has been virtually ignored. Chadda et al. (3,4) stated that positive guidance for pedestrians must be made up of four elements: advance information, transition information, work area information, and exit information.

Chadda et al. (4) described advance information as information placed at appropriate distances from the work zone that allows pedestrians to make timely decisions about alternative paths. The authors (3,4) noted that situations requiring pedestrian pathway blockage or detours are ideal for advance information and presented the following guidelines on the subject:

1. Advance information is needed if the pedestrian pathway is blocked or detoured,
2. Signs are most appropriate for this information,
3. Signs may be tailored to particular circumstances,
4. Signs should be strategically placed at points of decision, and
5. Pedestrian signals that no longer apply must be covered.

The authors (3,4) indicated that "Sidewalk Closed Ahead," "Sidewalk Closed—Use Other Side," and "Pedestrian Detour—Follow Arrow" are typical signed messages. The authors' illustration of a typical treatment for a corner sidewalk closure (3,4) is presented in Figure 2. The color code for pedestrian signs was not indicated. In another paper, Chadda et al. (5) noted that there is no uniformity in the design of pedestrian information. There was wide variation among the states on the colors, size, message, and placement.

Transition information allows pedestrians to find a safe path through and around work zones. This type of information is particularly important when the work activity restricts the width of pathways or requires a pedestrian bypass or detour. Chadda et al. (3,4) recommended the following guidelines on transition areas:

1. Transition to redefined or relocated pathways should be clearly delineated by either markings, tapes, tubes, cones, signs, wooden railing, barricades, portable concrete barriers, or other devices to provide positive guidance.
2. Physical barriers may be necessary to restrain pedestrians from using unsafe pathways and wandering into construction areas.
3. If the pathway is used at night, illumination or delineation with steady burn lights should be used.
4. All temporary crosswalks should be clearly delineated by signs and markings.

Work area information aids the pedestrian's passage through the work zone. This information is needed on all pathways except detours. Chadda et al. (4) recommend the use of devices that separate and protect pedestrians from the work activity and adjacent vehicular traffic and with clear delineation of pedestrian pathways. Markings, portable fences, barricades, flagging tape, cones, railings, barrels, drums, portable concrete barriers, and other devices were recommended for these purposes. The authors (4) noted that the selection of devices should be appropriate to the type of project and the nature of the hazards, and that pedestrians should be informed of pathway geometric and surface conditions that pose special hazards.

According to Chadda et al. (3,4), exit information becomes necessary only on new pathways involving bypasses and detours. Exit information can be communicated by signs and channelizations that direct pedestrians back to the original pathway.

Protection of Workers

A 1977 report (10) drew attention to the need for protecting workers in fixed and mobile work zones. The report noted that setting up fixed protection and working within the defined area expose employees to traffic hazards, and that consid-

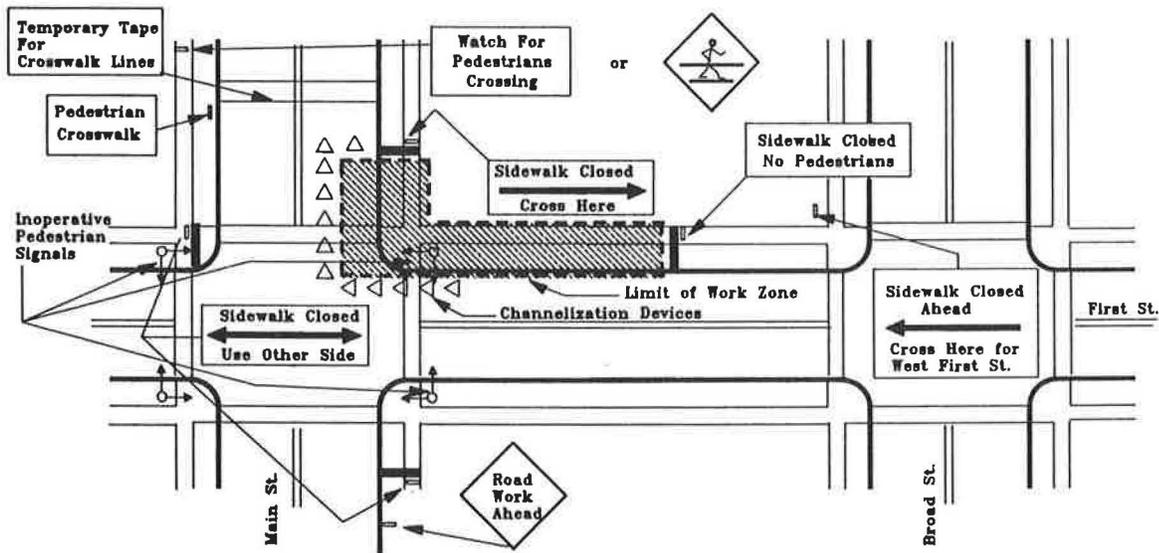


FIGURE 2 Pedestrian control for closure of sidewalk (2).

eration should be given to precast concrete safety-shaped barriers for positive guidance and protection of workers and motorists. For mobile operations, the report recommended the use of shadow vehicles equipped with energy absorbing devices as a buffer between workers on foot and the traffic approaching from the rear. Arrow panels were also recognized as being effective in providing advance warning to motorists.

An increasing number of fatalities involving maintenance personnel prompted Brackett (11) to investigate the effectiveness of the flagger's uniform in Texas. Two designs of an orange fluorescent mesh vest were developed and distributed in Texas for field use and evaluation: one involved the "11" striped pattern and the other a "W" striped pattern made with fluorescent reflective material. The study concluded that the "W" pattern was more recognizable and that stripes of brilliant yellow-green fluorescent reflective material should be used on traffic control vests. It was also recommended that the main body of the vest be made with red-orange fluorescent mesh material.

Gordon (12) also experimented with new designs for improving the effectiveness of the work-zone flagger's vest at nighttime. He advised that there is a need to be selective about the type of material for vest designs. Cotton, nylon mesh, and retroreflective bandoleer were identified as suitable materials for use during hot or cold weather and for providing good visibility during day or night. Vests made with white or silver-colored encapsulated or cube-corner reflective trimming were determined to be more effective at night. Gordon (12) discouraged the use of vertical or horizontal stripes for retroreflective patterns on vests. He advised that patterns that outline the flagger's figure are more recognizable than other designs at night. The author also recommended the 2 ft × 2 ft flag used to signal motorists be outlined with a 1-in. margin of retroreflective tape.

PEDESTRIAN PROTECTION PRACTICES

Despite deficiencies in pedestrian control information in work-zone manuals, occasional demonstrations of good pedestrian protection practices were observed in the states and cities visited: Albany and New York City, New York; Baltimore, Maryland; Chicago, Illinois; Lansing and Detroit, Michigan; Philadelphia and Harrisburg, Pennsylvania; Richmond, Virginia; San Francisco, California; and Washington, D.C. Observed efforts to ensure pedestrian safety in work zones are manifested in ways described in the following sections.

Building Codes

Contractors are expected to follow pedestrian safety requirements for work in public rights-of-way as stipulated by state and local building codes. These codes generally do not specify pedestrian safety treatments for diverse work situations. Contractors use their judgment in implementing pedestrian control measures. Local officials may review field sites to assess safety and recommend additional safety measures, if needed.

Building Permits

Local governments often require the review of building projects to ensure that adequate traffic control measures are taken during construction. The contractors rely on the limited information in work area traffic control manuals of cities, or the federal or state MUTCD. This is a routine practice in the large cities visited. Traffic engineering officials of Chicago, New York, and Philadelphia speak highly of this process, because it forces the contractors to submit traffic control plans—scaled detail or schematic, depending on the type of building—for approval before a building permit is issued. In large cities visited, all projects that use the public right-of-way (buildings, utility, and road work) are channeled through this review process. Specific devices, their message, size, location, placement, and period for application are approved by local traffic engineers.

Coordinated Management of Traffic

For major projects in San Francisco, a coordinated effort involving state and local traffic engineers, local police, and contractors is used when the disturbance caused by construction in urban centers—subways, freeways, skyscrapers, or rehabilitation of streetcar rails—is estimated to be major and long lasting. The coordination involves the participation of the police and traffic engineers in working with contractors in developing a mutually agreeable traffic control plan for all stages of construction. Subsequently, the police play a major role in enforcement.

Traffic Control Plans

Most states require traffic control plans for highway construction work. Pedestrian safety measures are detailed on traffic control plans where pedestrian traffic is anticipated. The California, Maryland, and Virginia Departments of Transportation use this procedure, although their work-zone manuals do not detail pedestrian protection measures.

General Specifications

Some states, Maryland and Virginia, for example, include a general statement about construction specifications or traffic control plans for highway projects indicating the need for contractors to provide for the safety of pedestrians. However, no details on pedestrian control devices are provided. Contractors are expected to use principles that are acceptable to state officials.

Coordinated Policy on Construction Safety

A coordinated safety policy that brings together several divisions of local government—maintenance, traffic engineering, building permits, police, and street cleaning—is used to

ensure that individual public works subdivisions do not work against the interest of pedestrian safety in work zones. This ensures that all construction projects that are likely to disturb public space are subject to traffic safety review before work is initiated. San Francisco routinely follows this strategy.

In spite of the measures described, the actual practice suffers from a general lack of policy to ensure continuing enforcement. Hence, the research team was able to observe many field practices that do not reflect the review and enforcement policies of local governments. A chronic problem that exists at the local levels of government is the lack of training of those individuals who must approve traffic control plans and inspect the field setup for compliance: the lower the cost of the project, the less stringent are the measures to protect pedestrians. This explains why contractors doing curb, gutter, and sidewalk work often display little sensitivity for pedestrian needs in downtown areas. This problem appears to be worse in cities where there are no formal guidelines for protecting pedestrians in work areas, and where approval of traffic control plans is not required for certain types of short-term roadway maintenance projects. A lack of state and local specifications on traffic control devices for pedestrians has allowed room for contractors to be creative about the message, color code, and placement of pedestrian information signs. The following sections provide a sample of field practices.

Pedestrian Information Signs

Pedestrian information signs vary widely in message, size, color code, and placement. An assortment of observed signs

and their respective messages and codes are indicated in Table 1. The colors of the worded messages are black, blue, green, red, red and black, and white. In addition, signs with lower formality were spray painted on portable concrete safety-shaped barriers. A flat nonreflective white background is most frequently used. Other observed background colors for pedestrian information signs were orange, yellow, and red. Combinations of black and red were being used to emphasize caution. Mounting height is also subject to wide variation.

Pedestrian Barriers, Canopies, and Fences

Barriers are used to protect pedestrians from work activities and to protect workers and pedestrians from vehicular traffic. The barriers are more prevalent in urban work zones when the construction activity is of long duration. The construction, demolition, and rehabilitation of buildings in downtown areas often require special efforts to ensure that work activities do not endanger pedestrians. To protect pedestrians from this type of danger, fences, canopies, and portable concrete safety-shaped barriers are being used.

Although several designs of fences and overhead protection structures were observed in all the cities visited, portable concrete barriers were less popular for that purpose. The naturally hilly topography of San Francisco has discouraged the use of portable concrete barriers for protecting workers and pedestrians in urban work zones. However, concrete barriers are often used in some cities, for example, Harrisburg, New York, and Philadelphia, as worker and pedestrian protection devices.

As indicated earlier, building codes are often the primary basis for the wide use of fences and canopied structures in

TABLE 1 Pedestrian Information Signs and Color Codes Used in Some Cities

Worded Message	Message Color	Background Color
1. "No Ped Crossing Use Crosswalk," with black arrow	Black	Reflective White
2. "This Stop Temporarily Discontinued Use Stop in Next Block," with black arrow	Black	Construction Reflective Orange
3. "No Bicycle Traffic Beyond This Point"	Black	Flat White
4. "Ped. Walk," with black arrow	Black	Flat White
5. "Sidewalk Closed Use Other Side," with or without black arrow	Black	Reflective Orange
6. "Sidewalk Closed Pedestrians Use Opposite Side of Street"	Red	Flat White
7. "We Apologize for the Inconvenience Please Follow Walkway to 49th Street," with blue arrow	Blue	Flat White
8. "West 49th Street Sidewalk Closed Please Use Other Side of Street," with blue arrow	Blue	Flat White
9. "Sidewalk Closed, Use Opposite Side of Street"	Red	Flat White
10. "Walkway," with red arrow	Red	Flat White
11. "Sidewalk Closed, Permit No. _____"	Red	Flat White
12. "Pedestrian Crossing," on diamond with black arrow	Black	Reflective Orange
13. "Caution Sidewalk Repair in Progress Please Pass with Care"	Red	Flat White
14. "Sidewalk Closed Please Use Other Side"	Black	Flat White
15. "Notice Sidewalk Closed Please Use Other Side"	Blue	Flat White
16. "Notice Sidewalk Closed Please Use Other Side"	Green	Flat White
17. "Sidewalk Closed Please Use Other Side"	Red	Flat White
18. "Sidewalk Closed" on diamond	Black	Flat White
19. "Pedestrian Walkway to 16th Street," with black arrow	Red	Flat Yellow
20. "Pedestrian Walkway to 16th Street," with black arrow	Black	Reflective Orange
21. "Sidewalk," with black arrow	Black	Reflective White
22. Impromptu "Walkway" signs spray-painted on concrete barriers	Any	Concrete
23. "Sidewalk Closed"	Red	Flat White
24. "Sidewalk Closed"	White	Flat Red
25. "Sidewalk Closed Caution"	Black & Red	Flat White
26. "Sidewalk Closed Pedestrians Please Use Other Side of Street," with blue arrow	Blue	Flat White
27. "Sidewalk Closed Please Use Pedestrian Walkway"	Red & Black	Flat White

urban building projects. The building construction industry generally follows the provisions of local codes. Traffic engineers are becoming increasingly aware that problems in the design of these devices can affect the capacity of walkways and limit sight distances at intersections. The city of Seattle, Washington, for example, requires fence corners at intersections to be made of chain-link material in driveways. Philadelphia, Pennsylvania requires the use of protective canopies in building construction as well as in maintenance activities above public thoroughfares to facilitate good visibility. Richmond, Virginia, has not yet documented its practice, but its officials no longer allow opaque construction fences or walls at intersections and, for example, window washing.

Delineation Devices

Methods for delineating pedestrian pathways include traditional devices such as cones, barricades, concrete barriers, orange construction tapes, and flashing warning lights for nighttime. Extensive use of pedestrian channelizing rails was observed in New York and San Francisco. Officials of both cities expressed satisfaction with the flexibility and performance of pedestrian channelizing rails such as those presented in Figure 3. These rails are used for pedestrian control in work areas, as well as for crowd and vehicular traffic control during emergencies and social events. Their design allows interconnection into a chain of any desired length, and they



FIGURE 3 Pedestrian channelizing rails used in San Francisco.

are sturdy enough to discourage movement by pedestrians and vandalism by motorists. The design used by San Francisco is presented in Figure 3. New York City uses a similar pedestrian rail system. San Francisco does not paint its rails but chooses to accent them with traffic cones as needed. New York City paints its rails bright yellow.

Recently, construction safety fences made of orange plastic have been appearing on roadway work in urban areas. They are available in 4-ft × 160-ft and 5-ft × 160-ft rolls and require a number of posts for installation. However, in many field installations, drums, barricades, and cones are draped by the orange plastic mesh. It is not known whether the mesh, used as drapery over standard devices, is contributing to further negligence in delineating pedestrian pathways. But with its bright orange color, the mesh is easily visible and has the advantage of closing gaps normally associated with standard barricades.

ASSESSMENT

The assessment summarized below and the conclusions and recommendations discussed later are based on a review of work-zone traffic control manuals of a selection of cities and states and a literature review and field observation of a sample of cities.

1. The safe accommodation of pedestrians and cyclists in work zones is often neglected by state and local governments. This neglect is more severe at the local government levels (counties, cities, and townships) than at the state level. However, the majority of work zones that affect pedestrians are located in urban areas where local safety standards are more prevalent.

2. Although the *Traffic Control Devices Handbook* (TCDH) (8) presents some principles for accommodating pedestrians in work zones, many local traffic safety personnel are not aware of its existence. In addition, since the TCDH is not a national standard, there has been no movement to adopt its guidelines on pedestrian safety into local practices.

3. City officials have recognized the need for guidelines for accommodating pedestrians in work areas, but few localities have included written guidelines in their work-zone traffic control manuals. Many cities, including high population centers, have no reference material on their pedestrian accommodation practices, and consequently, no standards for contractors to follow.

4. There is evidence that state highway officials routinely review projects planned for areas with pedestrian traffic to ensure the adequacy of safety measures. However, a lack of concern about the quality and maintenance of pedestrian control devices was observed on many state highway projects. The unavailability of published state standards on the design and application of devices for controlling and protecting pedestrians in work areas may explain the nonuniformity in the design of signs used in some state-administered roadway construction projects in large cities.

5. The state MUTCDs are generally a reflection of the federal MUTCD and have a similar deficiency in their methods for managing pedestrian traffic in work zones. State officials appear to be cautious about adopting formal guidelines on matters that have not been detailed in the federal MUTCD.

6. The actual practices of the state officials do not reflect the lack of information on pedestrian safety in their work-zone manuals. The traffic control plan review process presents ample opportunity to determine whether pedestrian needs will be adequately accommodated.

7. There is very little uniformity in the design and application of pedestrian control devices. The impact of using different colors for the same signed message on different backgrounds is not an apparent concern among state and local officials.

8. Inadequate attention is given to the geometry and surface quality of temporary pathways. The needs of pedestrians with ambulatory handicaps are often neglected.

CONCLUSIONS

1. The traffic engineering community, contractors, and utility companies involved in building construction and road work need safety standards for accommodating pedestrians and protecting workers in work zones.

2. Improvement of Part VI of the MUTCD (2), to include information on pedestrian accommodation and worker protection in work zones, has the greatest potential for promoting sound practice at state and local government levels.

3. There is adequate information on effective practices for managing pedestrians in work zones that could be considered for the MUTCD. The TCDH (8) is a good start.

4. The abuse of pedestrian rights in work zones can be blamed, in part, on the fact that many types of roadway and building maintenance work escape inspection by city officials or are reviewed and approved by inadequately trained personnel.

5. Work zones involving building construction and maintenance are common in urban areas. They frequently expose pedestrians to hazardous situations. Future improvement in Part VI of the MUTCD should cover pedestrian protection in such work zones.

RECOMMENDATIONS

1. Part VI of the MUTCD should be updated to include material on the principles for accommodating pedestrians in work zones, a standard set of traffic control devices and any caution regarding their use, a set of standard signs and guidelines for customized signs, delineation, illumination, and typical illustrations covering: (a) mid-block sidewalk closure with detour and bypass through pathways along the curb parking lane or through adjacent property, (b) corner closure of sidewalk, (c) crosswalk closure, (d) fencing near intersections, and (e) canopies for protecting pedestrians from the danger associated with overhead work.

2. Current practice leans toward the use of black and white signs for pedestrian information. There is a need to determine whether this practice should be officially encouraged, because these colors have a regulatory significance. There is no evidence that regulations were considered in their selection.

3. Figure 6-24 of the TCDH presents a typical application for controlling pedestrians in work zones. This figure details only a mid-block closure and provides no guidelines on the size and color of signs. This figure should be improved for inclusion in the MUTCD.

4. Sections 6B-5 through 6B-39 of the MUTCD deal with regulatory and warning signs for work zones. Standard designs for a selection of pedestrian signs could be included in these sections. This type of information would aid in standardizing the color codes for pedestrian signs. In practice, the majority of the pedestrian signs used in work zones are for warning. In upgrading Sections 6B-5 through 6B-39, there is need to determine whether there are standard regulatory signs that could be included. The text in these sections should be edited, where necessary, to reflect the added pedestrian information.

5. Section C of the MUTCD covers barricades and channelization devices from the perspective of motorists. That text should be modified to include pedestrians. Devices that are also applicable to pedestrian safety should be identified in the appropriate subsections. For example, barricades, drums, cones, and barriers should be identified as being suitable for channelizing pedestrian traffic. This section may also be the place to introduce and discuss other pedestrian channelization devices such as fences and pedestrian rails.

6. There is a need to determine whether Section 6A-5 of the MUTCD, which discusses fundamental principles, should be expanded to include principles that relate to pedestrian safety, or whether a separate section should be created for this purpose. It should be noted that some of the principles articulated in Section 6A-5 also apply to pedestrians and should not be duplicated. However, because there is a need to make the traffic safety community more sensitive to pedestrian needs, a separate section following Section 6A-6 should be considered. Its caption should include the word "pedestrian," and its contents should be oriented toward a number of briefly stated principles that apply only to pedestrians and are excluded from Section 6A-5. The text should cross-reference appropriate illustrations and other relevant material in the entire manual.

7. Workers are as vulnerable as pedestrians to work zone dangers. Practitioners who are far removed from the work site need to be made aware that workers are exposed to two dangers: the work activity and errant vehicles. Although many of the protection devices for pedestrians may apply to workers, a special section following the treatment of pedestrian-protection principles in the MUTCD should address principles that also apply to workers. Reference should be made to sections of the MUTCD that deal with flagger protection and the names and application of special worker protection devices. Typical situations that may warrant special worker protection measures should be noted. Concrete barriers, their connectors and anchorage, should receive special mention. There should be a brief discussion of worker dress, measures to ensure good visibility, and the need for organizations involved in highway work to maintain a continuing effort to promote work zone safety practices.

8. Section E of the MUTCD deals with lighting devices. The use of illumination and warning lights for pedestrian safety should be recognized. The illumination needs of detoured and canopied temporary walkways should be discussed.

9. Although retroreflectivity is not often a characteristic of pedestrian signs, the use of fluorescent material should be encouraged to improve visibility under all lighting conditions.

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