5

Walking in Madison: Issues, Current Conditions & Recommended Actions

The goal of this Pedestrian Transportation Plan is to develop strategies for making Madison an even better place to walk by enhancing the pedestrian environment and increasing the opportunities people have to choose walking as a viable mode of transportation. The plan's vision, goals, and objectives (Chapter 4) describe the pedestrian environment Madison would like to strive to develop and maintain. The flow chart at the end of Chapter 4 outlines the topics to address in developing strategies for making Madison an even better place to walk.

This chapter explores these topics in detail, including installation, design, construction and maintenance issues related to each topic, discussing current conditions and policies in Madison for each topic, and developing recommendations for making Madison an even better place to walk. The recommendations suggest practices to continue, ones to modify and new initiatives to undertake. Each recommendation identifies a specific action and the people/units/divisions/departments who should undertake it.

In the parentheses after each recommendation number, an indication of priority for implementation is listed: high (HIGH), medium (MED), low (LOW), continue current practices (CONT). Priority assignments take into account both desirability and feasibility of implementation. Especially for recommendations assigned a low priority, in many cases the desirability of implementation is high, but available resources make the feasibility of implementation low.

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Community and Site Development

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Pedestrian Facilities

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Introduction to Planning for Pedestrians

Madison's commitment to planning for pedestrians stems from an interest in enhancing the pedestrian environment and increasing opportunities to choose walking as a viable mode of transportation. Striving to achieve these goals involves attention to the physical environment as well as several other factors that have the potential to impact pedestrian travel. The following paragraphs briefly summarize a few of the issues considered for some of the major topics covered in this plan. These and more topics are explored in much greater detail in the remainder of this chapter.

Where destinations are close together and directly connected to the pedestrian network, the pedestrian network provides convenient route options, and there are frequent opportunities to cross the street safely, many people choose to walk.

Community and Site Development

Land Use Patterns **[see p. 43 for further discussion and p. 48 for recommendations]**

On a regional scale, land use patterns can significantly impact the viability of pedestrian travel. Where popular walking destinations such as parks, commercial districts, schools and other civic buildings are close together, walking is more viable than where they are highly segregated because trip distances are likely to be shorter in the former than in the latter.

Site Design **[see p. 48 for further discussion and p. 50 for recommendations]**

Site design refers to the arrangement of the building(s) and other amenities on a site and the architectural details of how the building(s) is designed. When the arrangement of the building(s) and other amenities provide a direct connection between the pedestrian network and the building, pedestrian travel is convenient and enhanced. Architectural design influences the visual interest of the pedestrian environment. Pedestrians generally consider intricate

architectural details and street level windows more appealing than 'blank box' designs.

Pedestrian Facilities

Walkways [see p. 51 for further discussion and p. 64 and 69 for recommendations]

The walkway network is characterized by how the sidewalks and pedestrian connectors combine together into a system. The continuity of this network and the scale of the grid created are two important considerations for pedestrian transportation planning. In a continuous walkway network, all sidewalks and pedestrian connectors lead to a destination without any gaps in the system along the way.

The scale of the network grid refers to the manner in which the walkways are interconnected. The farther a pedestrian has to walk before s/he encounters an opportunity to turn, the coarser the scale of the pedestrian grid. When the grid is more coarse, pedestrians have fewer route options and they will likely have to take a more indirect route to their destination than if the pedestrian grid were finer. The pedestrian grid is independent of the street network. In many cases the pedestrian grid will follow the street network, but this need not be the case. Pedestrian connectors at ends of cul-de-sacs, mid block, and over/under/across barriers such as freeways and rail road tracks are examples of elements of the pedestrian network that do not follow along the street network. These connectors are often significant features of the pedestrian network in areas where simply following the street network does not provide a fine enough scale pedestrian grid.

Street Crossings [see p. 72 for further discussion]

Two characteristics that impact how conveniently and safely pedestrians can cross a street are accessibility and frequency of opportunities to cross. Curb ramps are the most common pedestrian facility installed to enhance accessibility at pedestrian crossings. Frequency of opportunities to cross a street is influenced by the volume of traffic, speed of traffic and the pattern of its flow. Typically, pedestrians find more opportunities to cross a street when there is less traffic, when it travels more slowly and/or when it travels in platoons.

Other Factors Impacting the Pedestrian Environment

Education [see p. 118 for further discussion and p. 125 for recommendations]

Beyond the facilities provided for pedestrians, people's behaviors can impact the accessibility, convenience, safety and enjoyability of pedestrian travel. Pedestrians, motorists and bicyclists alike benefit from educational efforts targeted at understanding the rights and responsibilities each group has in interacting with the other travel modes. It is also beneficial to have design professionals and law enforcement officers understand these rights and responsibilities.

Encouragement [see p. 126 for further discussion and p. 127 for recommendations]

Providing a continuous pedestrian network helps to encourage walking by making walking a viable transportation choice. Sometimes programs targeted at encouraging walking can further increase the number of people who choose to walk. Encouragement programs such as walking tours, walk to work days, media campaigns and employer incentives promote walking as a viable and desirable transportation choice.

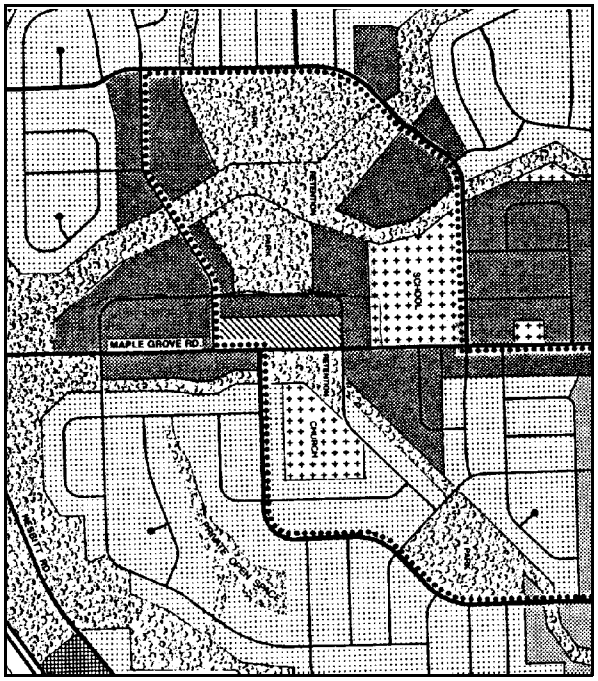
Enforcement [see p. 127 for further discussion and p. 129 for recommendations]

Pedestrians, motorists and bicyclists who do not follow pedestrian-related laws can detract from the viability of pedestrian travel. For example, motorists often fail to yield to pedestrians in crosswalks. Targeted law enforcement programs have the potential to improve understanding of and compliance with these regulations, thereby contributing toward making Madison an even better place to walk.

Community and Site Development

Planning, Zoning and Land Use

Research indicates that in order to be effective, the process of planning pedestrian facilities must take place within the framework of the overall planning process already in existence. It must proceed in parallel with the planning of other land use and transportation elements, such as comprehensive planning, sub-area planning, zoning and capital budgeting. Pedestrian planning cannot be divorced from this overall process. Pedestrian needs must be effectively advocated within that process.



This section of the neighborhood development plan for the Cross Country neighborhood on Madison's far west side shows the proposed street network and land uses.

The Public Planning Process

Research into local and state planning processes revealed several key elements that appear to be consistently present in jurisdictions that are adequately treating pedestrian accommodations in their planning process. The key elements include:

< Policy statements in the comprehensive plan (also called a Master Plan or General Plan) that relate to pedestrian needs and objectives.

One of the threads that appear to consistently run through the planning process in all of the successful jurisdictions is a recognition of pedestrian needs at the most basic level -- statements of jurisdictional objectives and policies. All of these jurisdictions have aggressive pedestrian planning efforts underway and these efforts are in turn based on policies and objectives stated in a document guiding planning throughout the jurisdiction. Although policy statements in the comprehensive plan do not automatically guarantee the provision of any pedestrian facilities, they at least indicate that a recognition exists of the need to plan for the pedestrian. Having this recognition at the top level of the planning process increases the likelihood that further steps will be taken toward actually planning for and implementing pedestrian facilities.

< Inclusion of pedestrian facilities in the comprehensive plan.

Many communities around the country have established a comprehensive plan governing land use and public facility development, including a master plan for pedestrian facilities. This forces specific thought to be given to how pedestrians should be accommodated and provides the framework around which other development activities, both public and private can be designed.

< Preparation of sub-area or sector plans for areas needing special coordination.

The planning process sometimes entails the preparation of sub-area or sector plans. Such plans are an ideal forum for the inclusion of pedestrian planning needs. While there is no assurance that the concepts and recommendations within these neighborhood plans will be built as shown, every effort has been made to elevate pedestrian needs in both the sub-area development policy and visually through illustration. Sub-area plans can serve as the basis for policy that could guide the concept through to implementation.

< Careful attention to the implementation process.

Many of the problems that exist with the pedestrian system are the result of inattention to detail, various institutional impediments or general lack of follow-through on the implementation stage. Many of the flaws in the pedestrian network can also be traced to these implementation related problems. The communities that exhibit good pedestrian systems have obviously given substantial thought to the entire implementation process. Several have developed a more formal framework that guides the process of pedestrian facility implementation from initial inception and

planning through construction and subsequent management.

< Knowledgeable person(s) on the planning or engineering staff with specific pedestrian related responsibilities.

Another element that jurisdictions with effective pedestrian planning activities have in common is a public agency "advocate" for the pedestrian -- someone assigned the task of directly planning for pedestrians needs or for ensuring that the overall planning process did not neglect the pedestrian. Typical job responsibilities for a public agency pedestrian advocate include preparing master walkway plans and pedestrian elements of the sub-area plans, providing pedestrian related input on other planning activities, reviewing site plans from the pedestrian point of view, responding to citizen inquiries on problems with the pedestrian system, and coordinating the preparation of pedestrian-related elements of the capital improvement program.

The Role of Private Land Developers

Part of the research effort included an investigation into the role of private land development and the provision of pedestrian facilities. Developers are ever more an integral part of the planning and construction of the transportation system and have an especially prominent role in the provision of pedestrian facilities, ranging from sidewalks on the periphery of the developments to pathways provided for internal pedestrian circulation.

From the developer's perspective, several observations can be made.

1. Pedestrian considerations are one of a multitude of factors involved in the development process and must compete with other design and financial priorities. However, when integrated into the development plans from the outset, basic pedestrian facilities can be a relatively small cost, and they can improve pedestrian circulation overall and add to the marketability of a property.

2. A balance is needed in the flexibility of local zoning and subdivision regulations. Over regulation will stifle design, while no regulation will continue to permit pedestrian neglect to occur among developers who have less concern for pedestrians. Legal instruments such as zoning and subdivision regulations are implementation tools that can be used to shape the placement and design of pedestrian related facilities. Unfortunately, these tools can also inhibit good design when used in a rigid and inflexible way. The dilemma is one of providing flexibility while ensuring the basic elements of a pedestrian system are built.

3. A simple checklist or guidelines can be useful in reminding both the developer and reviewer of plans about items that should be considered in the planning of pedestrian facilities.

4. Guidelines for sidewalk installation and other pedestrian facilities including funding responsibilities should be clearly outlined in local ordinances, warrants and specifications.

Evolving Nature of Land and Highway Development

Another part of the research effort included some findings concerning the evolving nature of land and highway development. Urban and growing areas are in a constant state of transition. This complicates the provision of certain public facilities, particularly those related to transportation. Changes to activity centers over time require streets and highways to handle traffic levels they were not designed to accommodate. Many of the needs for pedestrian travel are also not foreseen nor preserved. In many cases with the evolving nature of land development, it is a classic "chicken and egg" situation in which pedestrian networks cannot be justified because of general absence of pedestrians, but the lack of pedestrian connections between uses discourages pedestrian travel. In addition, there is the tendency to want to wait until the road is improved before committing the pedestrian paths or sidewalks. Although some improvement can be made to retrofit the situation, the better, less costly solution is to have planned for the pedestrian from the beginning. Some simple principles built into local ordinances and regulations to foster implementation will increase the likelihood of adequate facilities being provided in most developing and evolving land areas. These principles include:

- Either a shoulder or separate pathway should be available to safely accommodate pedestrians walking along arterial or collector roadways.
- Keep open the possibility of direct connections between residences and activity areas.
- Determine eventual roadway cross sections and sidewalk standards at the earliest possible date so that new development will consistently be built to the same standard.
- Sidewalks and pathways should be required along all developed frontages of arterial and collector streets.
- Large planned developments should be encouraged over smaller, single use developments.

The Relationship Between Land Use Patterns and Pedestrian Facilities

Another part of the research effort included findings concerning the relationship between land use planning and pedestrian facilities. Any discussion of pedestrian planning cannot overlook the importance of land use planning and the role that spatial relationships among land uses play in building an environment that is friendly to pedestrians. A propensity for walking is heavily dependent on the distance between the origin and destination of each trip. Thus, locating origins and destinations closer to one another can have positive influence on pedestrian travel. This can be accomplished in two primary ways.

1. Locating mutually attracting land uses in close proximity to one another or avoiding the proliferation of single use development, and
2. Increasing the density of development so people have a greater degree of access to a wider range of services and facilities.

This is why the typical central city is more pedestrian oriented than suburbs. Part of the premise is that closer coordination between land use and transportation can dramatically reduce the need for travel in private cars and accommodate more people through a combination of foot (and wheels), bicycle, transit and carpool use. Such land use changes and coordination would make walking and bicycling from home-to-shopping, work, play or transit stop more likely. To encourage and accommodate people to walk, there needs to be a land use pattern to serve their needs.

Madison Context

At various points, City of Madison staff and committees have recognized the relationship of pedestrian issues with planning, land use, zoning and development. There appears to be considerable interest but it also appears that more needs to be done to foster more pedestrian oriented development.

Neighborhoods in different parts of Madison are characterized by very different mixes and distributions of land uses. In general, older parts of the City have more different land uses intermingled than newer parts of the City. In the newer areas, land uses tend to be highly segregated and many neighborhoods are comprised solely of residential housing with the commercial areas serving the neighborhood located in large regional shopping malls a mile, or often more, away. The differences in these land use patterns is demonstrated dramatically by the City's land use map, which color codes each land parcel in the city according to how the land is being used. In the more central parts of the city, many of which were developed in the pre-automobile era, the map shows many small blocks of many different colors all mixed together. On the other hand, the areas of the map showing the more recently developed areas at the city outskirts are characterized by large, single color blocks.

These alternative land use patterns impact pedestrian travel very differently. It is possible to provide adequate walkways and crossings throughout each of these areas, but despite similar facilities, the number of people who walk and the types of trips they make by foot will vary significantly between these land use patterns.

In the mixed-use pattern, more destinations will be within walking distance and it is more likely that residents are able to meet more of their daily needs by walking. The Dudgeon-Monroe neighborhood is an example of a mixed land use pattern that has created a neighborhood oriented to walking. Ken Kopps, Neuhausers and Mallatts provide convenient grocery shopping and pharmaceutical services. A bank, a library, a dry cleaner, several parks, and many restaurants also contribute to the residents' abilities to meet their daily needs by walking in the neighborhood. Several specialty shops also contribute to the neighborhood's diversity. Seasonal festivals at Edgewood, Wingra Park and on Monroe St. itself also add to the neighborhood's pedestrian orientation.

In neighborhoods with highly segregated land use patterns, walking may be limited to recreation and visiting neighbors. Even if an adequate pedestrian transportation network is in place in these areas, many of the destinations residents wish to reach are too far away for

most people to consider walking a viable transportation option. In this case a strong transit system is especially important to effectively extend the pedestrian's range. Consider, for example, the Wexford Village neighborhood on the City's far west side, bordered by Gammon Rd. and the Beltline on the east and west and Old Sauk Rd. and the City limits on the north and south. For these residents, the nearest grocery store is Cub Foods at West Towne, more than a mile away. The nearest pharmacy is the Walgreens in the strip mall on Mineral Point Rd. near the Beltline. Restaurants and banks are also concentrated in the West Towne area rather than being integrated throughout the neighborhood. They are mostly big chains in big buildings with no convenient, safe or enjoyable pedestrian access between them.

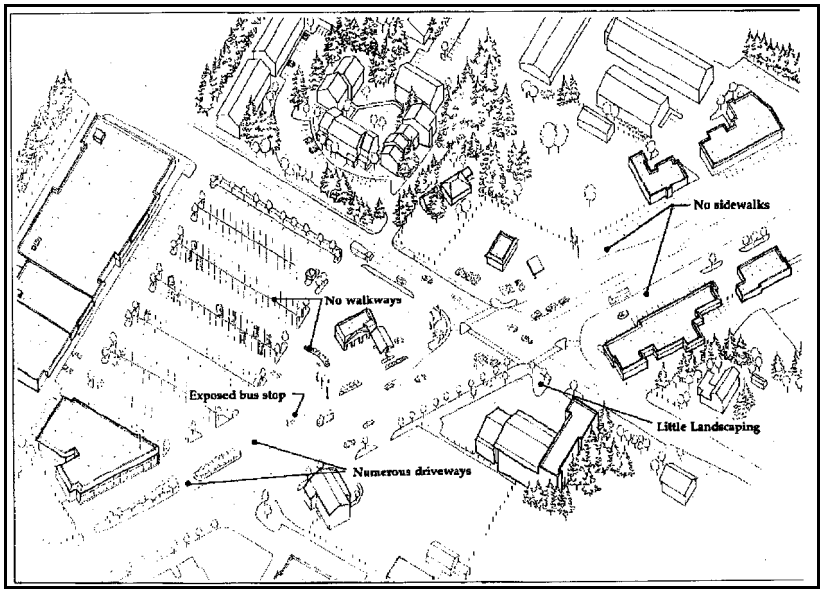
Therefore, from a pedestrian perspective, as the City develops new neighborhoods and redevelops already built up areas, it is more desirable to encourage mixed rather than segregated land use patterns.

PLANNING, LAND USE, ZONING AND DEVELOPMENT RECOMMENDATIONS

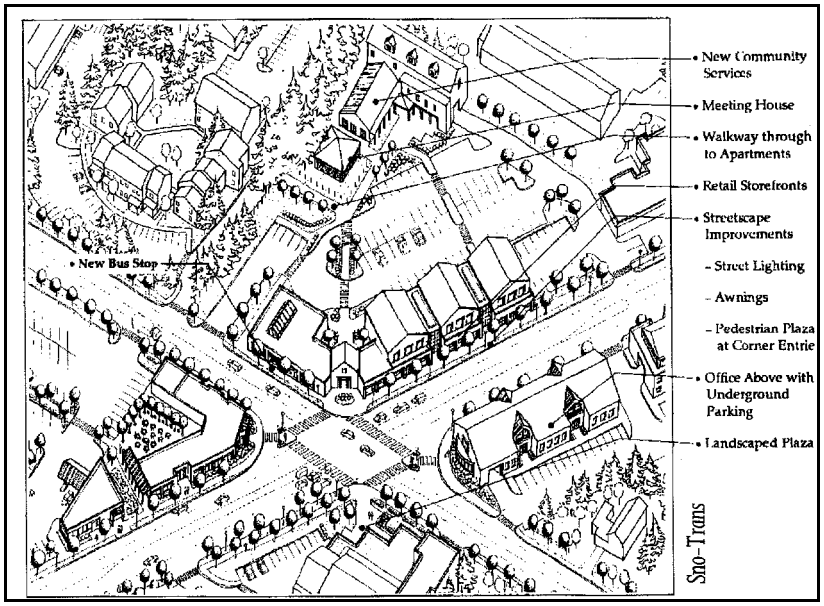
1. (HIGH) The Transportation, Public Works and Planning and Development Departments shall work with interested organizations, developers and City commissions to develop and adopt new comprehensive guidelines, ordinances and other measures that will foster pedestrian oriented planning, land use, zoning and development.

Site Design

There are two major arenas in which pedestrian planning design and implementation must take place. The public arena primarily includes the area within the highway right-of-way as well as public spaces such as parks and recreational areas. The private arena encompasses the property in which development projects are built. Site design is defined by one source as, "*...the art of arranging structures on the land and shaping the spaces between.*" Effective site design cannot be totally regulated but must partially emulate from the creativity and practicality of the designer. The designer must make the best use of the natural features of the site and its surroundings in light of the intended functions of facilities to be placed on the site. It is critical that the designer be cognizant of the needs of the pedestrian and consider the implications of site design decisions on pedestrian movements. This is what is meant by pedestrian sensitive site planning. One cannot expect pedestrian needs to dominate over all other needs but the site planning process should be at least sensitive to those needs.



Redeveloping a strip commercial area to be pedestrian oriented: Before
[From Redevelopment for Livable Communities, Energy Outreach Center, Olympia, WA, p. 37.]



Redeveloping a strip commercial area to be pedestrian oriented: After
[From Redevelopment for Livable Communities, Energy Outreach Center, Olympia, WA, p. 37.]

A pedestrian sensitive site plan is one in which the pedestrian is recognized as a significant factor in shaping the arrangement of on-site facilities and the relationship of those facilities to others nearby.

Case study reviews and other research suggest that the following factors or design objectives are important to pedestrian sensitive site planning.

< A continuous pedestrian network connecting origins and destinations with pathways that are direct and barrier free. Recreational pathways should be continuous but need not be direct.

< Minimum number of conflict points between pedestrians and motor vehicle traffic. Consider ways of organizing the site to reduce the number of places where pedestrians will cross vehicular flows, particularly heavy flows.

< Minimum impedance to the pedestrian in terms of the amount of time, distance or energy expenditure.

< Clear delineation of pedestrian paths to ensure that effective walking routes can be selected. Visual queues should logically lead the pedestrians to their desired destinations, but signs may also be necessary, particularly on the larger sites.

< Pedestrian facility design for ease and maintenance. Failure to do this has led to the

demise of numerous well intentioned and otherwise well thought out plans.

- Provision of amenities (greenery, shade trees, benches, etc.) to enhance the walking experience.
- Consideration of special pedestrian needs. Certain groups of pedestrians have special needs which need to be considered in the layout and design of facilities.
- Facilities designed to maximize pedestrian security. Depending on the setting, the pathway that is not visible from parking lots and buildings can pose a security problem.
- Other factors relating to the site design include such things as pedestrian walkways and amenities, building orientation, landscape design, architecture, parking lot design and transit orientation.

Madison Context

At various points, City of Madison staff and committees have recognized the relationship of pedestrian issues with site planning. There appears to be considerable interest, especially at the joint subcommittee of the Transportation Commission and Plan Commission, but it also appears that more needs to be done to foster more pedestrian oriented site design and development.

SITE DESIGN RECOMMENDATIONS

2. (HIGH) The Transportation, Public Works and Planning and Development Departments shall work with interested organizations, developers and City commissions to develop and adopt new site design guidelines, ordinances and other measures that will foster pedestrian oriented site design, including such design features as pedestrian connectors and amenities, building and entrance orientation, landscape design, architectural design, parking lot design, and transit orientation.

Pedestrian Facilities

Walkways: Sidewalks

Sidewalks are the backbone of the pedestrian transportation network. They facilitate pedestrian mobility between and access to desired destinations. Where sidewalks are not provided, people either don't walk, or they walk in the street or develop a worn rut path adjacent to the roadway (see photo of Gammon Road south of the Beltline to the right. Note that in this case, this missing sidewalk link has since been installed.)

Worn ruts often develop adjacent to the roadway where sidewalks are not provided, indicating a demonstrated need.

There are a number of elements associated with good walkway corridors:

Accessibility: The walkway is easily accessible to all users, whatever their level of ability.

Adequate Travel Width: Two people walking together can walk side by side comfortably. In areas of intense pedestrian use, sidewalks are be wider to accommodate the greater volume of pedestrians.

Comfort/Buffer: Walkways allow pedestrians to feel a sense of safety and predictability. Space is provided between the travel way and the walkway so that sidewalk users do not feel threatened by adjacent traffic.

Continuity: The walking route along a walkway is obvious and does not require excessive out-of-direction travel.

Landscaping: Street trees and plantings along the walkway provide shade and contribute to the psychological and visual comfort of walkway users.

Social Space: Walkways provide places for interaction between people and a place where children can safely participate in the public realm.

Visual Quality: Walkways contribute to the character of neighborhoods and business districts, and strengthen their identity.

There are a number of issues associated with not providing sidewalks (see related discussion in Chapter 3). More pedestrian crashes than expected based on exposure occur on streets without sidewalks. Fewer people walk in areas where there are fewer walkways. Further, the young, the old and the disabled often rely on walking for transportation and therefore find it difficult to live in neighborhoods without a complete walkway network.

The objectives in Chapter 4 outline the role that sidewalks should play in making Madison an even better place to walk. Considerations related to sidewalks fall into three basic categories:

maintaining sidewalks where they already exist (preserving good areas to walk), installing sidewalk in new construction/development, and retrofitting sidewalk during street reconstruction projects. The following sections outline and evaluate current approaches to sidewalk installation, design and maintenance as they relate to each of these three situations (see table below for a summary of page references for topics included in the sidewalk discussion).

Sidewalk Discussion Reference Guide

Sidewalk Installation Criteria

Sidewalk installation criteria need to address at least two central issues: current City policy and the long term impacts of decisions made today. As outlined in Chapter 1 of this plan, current City policy as outlined in both the Comprehensive Master Plan and the Regional Transportation Plan strongly advocates for pedestrian transportation. These plans promote designing a transportation system that provides diverse travel modes as viable transportation choices, including walking and transit. Therefore, these plans advocate for sidewalks and pedestrian connections to transit stops.

Neighborhoods touted today as some of the City's most walkable areas were developed with sidewalks from the beginning. Experience has shown that if sidewalks are not installed at the

time a neighborhood is developed, it is often very difficult to gain political support in the neighborhood to retrofit sidewalks in the area. Also, although City policy states that the street right of way should be graded for sidewalks at the time of development even if the sidewalks are not installed at that time, this often does not happen and further complicates sidewalk retrofitting in the future.

Sidewalk installation criteria apply to two situations: new development and retrofitting already developed areas. Within already developed areas, sidewalk retrofitting can be pursued either as part of a larger street reconstruction or frontage improvement project, or it can be pursued as an independent project.

Sidewalk Installation in New Developments

The Madison General Ordinances [16.23(9)(d)(6)] define the City's current policy related to sidewalk installation in new developments:

- "The Subdivider at his/her sole expense, shall install public streets and walkways within the subdivision in accordance with the plans prepared by the City Engineer."
- "Public walkways or sidewalks shall be installed within all public rights-of-way and public walkway easements unless the Plan Commission, after considering the recommendations of the Planning Unit Director, the City Engineer and the Traffic Engineer, determine that public walkways are not required. In making this determination, consideration shall be given to anticipated pedestrian volumes, pedestrian access to schools or bus routes, continuity of the sidewalk or bicycle route systems, land use density, cul-de-sacs or loop street patterns, and the pattern of development of adjacent lands. The installation and location of public walkways may be modified to protect and preserve significant trees."
- "The subdivider shall install public walkways or sidewalks within the right of way of existing streets on the perimeter of the subdivision."

Several reasons explain why some areas do not have sidewalks despite this strong policy. First, some neighborhoods were developed in the 1950's when the City's policy did not require sidewalks (e.g. Nakoma and Orchard Ridge). Also, some areas were annexed by Madison after they had already been developed. In many cases, the townships to which these areas originally belonged did not require sidewalks. Finally, the Plan Commission, as stated in the ordinance, has the authority to exempt a new subdivision from installing sidewalks. These exemptions should consider the recommendations of the Planning Unit Director, the City Engineer and the Traffic Engineer. A recent example is the sidewalk exemption that the Plan Commission granted to the new Michael's Frozen Custard on Schroeder Road, although staff recommended requiring sidewalks based on traffic conditions and demonstrated pedestrian use in the area. Since this time there have been enough citizen requests for sidewalk in this location that the City has gone back and filled in this missing link.

Sometimes developers petition the City for an exemption from the requirement to install sidewalks and in several recent cases their petitions have been granted. Because of the long term transportation impacts of these decisions and the City's strong policies advocating

sidewalks, the circumstances of these exemptions should be reviewed and evaluated.

Retrofitting Sidewalks in Already Developed Areas

There are three different types of situations in which sidewalks are retrofitted into already developed areas: stand alone project, street reconstruction or site redevelopment projects. Installation of sidewalk in an already developed area as a stand alone project is typically based on citizen requests and neighborhood support. Retrofitting sidewalks as an integral component of a street reconstruction is generally more cost effective than as a stand alone project because the equipment, materials and construction workers needed to install the sidewalk are already at the site for the street reconstruction. Many times when sites are redeveloped, the developers are required to get certain permits or approvals from the City. In these cases, the City may require the developer to install sidewalks on the site if they do not currently exist.

Retrofitting sidewalks in already developed areas is a more complicated issue than for new developments. There are two primary considerations: feasibility and desirability. Feasibility encompasses political and financial feasibility and neighborhood support. Because property owners pay the total cost of installing a new sidewalk, the neighborhood's and property owner's desire to either install or not install a sidewalk has as much if not more weight in the final decision as the sidewalk's importance to the pedestrian transportation network. Especially when there is no standard procedure for evaluating a proposed sidewalk's importance to the transportation network, debates about whether or not to install the sidewalk have the potential to be based more on emotion than logic. Not too surprisingly people who argue against sidewalks complain they do not want to pay for them, that they do not want to shovel them and that they specifically bought the house because it did not have sidewalks. Also not too surprisingly, people who argue for sidewalks stress how sidewalks are to pedestrians as streets are to cars and how important sidewalks are for pedestrian mobility and safety.

Just as with new developments, sidewalks are desirable in most situations in already developed areas. A particularly high priority is placed on arterial and collector streets because traffic patterns on these streets do not allow pedestrians and vehicles to safely mix and destinations are commonly concentrated in these corridors. Prioritizing missing segments within arterials and collectors is based on continuity of the pedestrian transportation network, proximity to schools, commercial districts, and bus stops and a demonstrated need (often identified by a worn rut path). Also, proximity to other destinations such as parks, senior centers and other public buildings is sometimes considered.

Prioritizing missing segments along residential streets considers continuity of the pedestrian transportation network, traffic conditions and demonstrated need as with arterial and collector streets. 'Through streets', which are intended to provide people mobility through developments, are a high priority. Development density, which is related to proximity to destinations, is also considered. In addition to these factors, neighborhood support is a particularly important issue to consider in making decisions about retrofitting sidewalks on already developed residential streets.

All improvements to existing streets without sidewalks should evaluate the criteria listed below in determining the importance of including sidewalk installation in the construction project. All sidewalk installations in already developed areas to be considered as stand alone projects should consider the same criteria as for sidewalks installed as a component of a street reconstruction except that more weight should be given to neighborhood support and demonstrated need.

RETROFITTING SIDEWALK IN ALREADY DEVELOPED AREAS: INSTALLATION CRITERIA

Desirability

- **!** Continuity of Pedestrian Network.
- **!** Sidewalks to be installed on arterial and collector streets are a higher priority than local residential streets.
- **!** For arterial and collector streets consider:
  - , Proximity to schools, commercial districts, bus stops
  - , Demonstrated need and/or potential use
- **!** For local residential streets consider:
  - , Through street classification
  - , Traffic conditions
  - , Development density
  - , Demonstrated need

Feasibility

- **!** Project cost
- **!** Funding availability
- **!** Alder support
- **!** Neighborhood support
- **!** City staff support

When the existing right-of-way is too narrow to accommodate both street and sidewalk, several steps can be pursued to allow room for a sidewalk, including acquiring additional right-of-way or a public walkway easement and narrowing existing roadway in accord with established minimum roadway standards. Narrowing the existing roadway may require removal of on-street parking.

Sidewalk Design

Walkways should be designed to enhance pedestrian access and mobility. Design issues to consider include width, shy distance, slope, rail crossings and grates, vaults and access structure covers.

The City's *Standard Specifications for Public Works Construction* outlines many guidelines related to sidewalk design. In addition, there are several national publications that offer guidance about how to design sidewalks: the Transportation Research Board's *Highway Capacity Manual*, the American Association of State Highway and Transportation Official's *Policy on Geometric Design of Highways and Streets*, and the Institute for Transportation Engineer's *Design and Safety of Pedestrian Facilities*.

Sidewalk Design: Width

Section 10.06 of the Madison General Ordinances defines several aspects of sidewalk design:

- "All new sidewalks shall be constructed of concrete;"
- "All new sidewalks shall be constructed in accordance of the latest edition of the City of Madison *Standard Street and Sewer Specifications* and all addenda and supplements thereto;"
- "Sidewalks shall be 5 feet wide unless directed by the City Engineer; and"
- "No sidewalk shall be constructed or reconstructed under the provisions of this section without first obtaining a permit from the City Engineer showing the location and required width of the proposed work. There shall be no charge for this permit."

The *Standard Street and Sewer Specifications* manual referred to in the ordinance is actually titled *Standard Specifications for Public Works Construction*. These specifications (p. 122-126) detail how the foundation for the sidewalk should be prepared, what forms should be used, how joints should be formed, concrete thickness and reinforcement requirements.

A sidewalk that has a minimum clear width of five feet allows for safe and convenient pedestrian travel because of the following characteristics:

- allows two persons to travel abreast or to pass;
- allows persons with strollers, carriages or shopping carts or person in wheelchairs or using walkers to easily pass each other;
- provides queuing space for pedestrians at street corners and crosswalks; and

< provides space for children with tricycles, wagons or in-line or roller skates and provides space for other childhood games and activities while accommodating pedestrian use.

Some situations warrant walkways wider than the five feet. Additional width should be provided in areas with higher volumes of pedestrian traffic, including commercial areas, downtown central business districts, near schools, and higher density residential areas. Also, the combined width of the sidewalk and the terrace should be wider on collector and arterial streets with higher traffic volumes and speeds. This can be achieved either by widening the terrace and/or widening the sidewalk. In addition, the *Highway Capacity Manual* explains that moving pedestrians will shy away from the curb, and will not press closely against building walls. Therefore, unused space must be subtracted when determining pedestrian level of service. The manual suggests sidewalk widths based on a capacity analysis. Further, a strip preempted by pedestrians standing near a building (as in window shopping) and/or near physical obstructions such as light poles, mail boxes, and parking meters, should also be excluded.

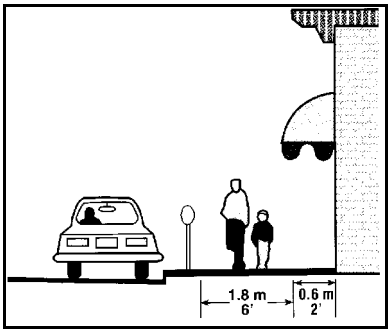
In some situations it is desirable to have sidewalks wider than five feet, such as shown here on the Capital Square where pedestrian volumes are particularly high.

It is desirable that the overall width of a walkway never be less than five feet. Parking meters, planters, mail boxes, light poles, signs and other street furniture should be located in terrace adjacent to the walkway so that these potential obstructions do not narrow the width of the walkway. Where there are extreme right of way constraints and an obstruction in the walkway cannot be avoided, the walkway should have a minimum clear usable width of at least 36 inches at every point along its length.[1] This reduction in effective sidewalk width should only be allowed in extreme conditions where a localized reduction in width cannot be avoided. However, even if such a narrowing is allowed, the minimum clear usable width should never be allowed to be less than 36 inches, because a single obstruction at one point on a route that reduces the width to less than 36 inches can render an entire walkway unusable as a route for wheelchair users, stroller users or anyone else trying to push or pull something that is greater than 36 inches wide.

[1]Institute for Transportation Engineers, *Design and Safety of Pedestrian Facilities*; ADA Chapter 14 Interim Final Rule.

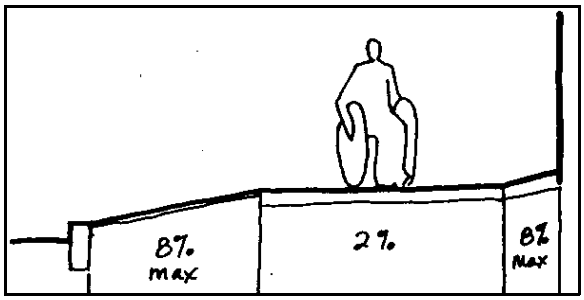
Sidewalk Design: Shy Distance

Pedestrians naturally shy away from vertical barriers such as buildings, sound walls, retaining walls and fences that are directly adjacent to a sidewalk. In these cases, it is desirable to provide a wider sidewalk to accommodate the pedestrian's likely travel path. In addition, where commercial store fronts directly abut the sidewalk, sidewalks should be greater than five feet to allow space for people who are window shopping.



Pedestrians naturally shy away from vertical barriers such as buildings, sound walks, retaining walls and fences.
[From Oregon Bicycle and Ped Plan, p. 92]

Sidewalk Design: Slope



Sidewalk slope influences drainage and wheelchair accessibility.
[From Portland Ped Guidelines, p. B-6]

Sidewalk slope is important for several reasons. A slight slope promotes drainage from the sidewalk. This can be achieved either through a slope in the direction of travel along the sidewalk (running slope), or across the direction of travel (cross slope). If either the running slope or the cross slope is too great, however, travel becomes difficult or impossible for wheelchair users. The City's *Standard Specifications for Public Works Construction* specifies that the cross slope should not exceed two percent.

Sidewalk Design: Rail Crossings

Where railroad tracks cross sidewalks at grade, the surface of the sidewalk should be level and flush with top of the track at the outer edge and between the tracks. Large vertical displacements between the tracks and the sidewalk makes travel difficult for all pedestrians. Large horizontal gaps between the edge of the sidewalk and the railroad track are problematic for wheelchair users and for people pushing strollers because their wheels can get caught in the gap between the edge of the sidewalk and the track. To accommodate both pedestrian and train traffic, the horizontal gap on the inner edge of each track should be the minimum necessary to allow passage of the train's wheel flanges.

Sidewalk Design: Vault and Access Structure Covers and Grates

When vault and access structure covers and grates get wet they can be slippery for pedestrians. Also, if there is a large vertical displacement between the sidewalk surface and the cover or grate, similar problems to sidewalks in general disrepair are likely to arise. Therefore, whenever possible, it is desirable to place vault and access structure covers and grates outside the sidewalk. When the only possible location is within the sidewalk, the surface of the cover or grate should be as flush as possible with the surrounding sidewalk and should be slip resistant.

Sidewalk Maintenance: Cracked and Uneven Sidewalks

Sidewalks are constructed with unreinforced concrete laid on natural ground. They are susceptible to breakage by heavy trucks and equipment, displacement by tree roots and trunks, and settling utility trenches excavated beneath the sidewalk. During the winter, frost penetrates the soil under the sidewalk to a depth of six feet. Frost causes the soil to expand which can create vertical offsets between individual sidewalk blocks. These offsets may or may not be eliminated when spring comes.

Although desirable in an ideal world, the factors described above (and those discussed in the next section) limit the practicality of maintaining a smooth, level sidewalk surface at all times of year. There will always be some natural heaving and settling due to the ground freezing and thawing. Therefore, pedestrians should watch for offsets and wear appropriate footwear.

City Engineering estimates it replaces 25-35 percent of existing sidewalk each time it goes into a neighborhood to do sidewalk maintenance and that if it could get through all the City's neighborhoods on a 10-year cycle it would be able to better maintain the City's sidewalks as level as is practical in our climate.

In 1996, the Madison Common Council approved a 10 year sidewalk maintenance program. The annual budget for the City's sidewalk program is approximately $700,000 (1996 dollars) (including both the City's and the property owner's share), which includes not only sidewalk repair, but also repair of curb and gutter and installation of curb ramps. The annual program consists of two contract types: "ordered" and "requested." The ordered contract targets a neighborhood or specific geographic area of the City and requires Common Council approval. For example, the 1994 program targeted the Schenk School area. For 1995, it targeted the Mendota Street area. In 1996 and 1997 it will focus on the Sherman-Northport-Cherokee area. The program the Council approved outlines a plan to cover the entire City in the next 10 years. In addition to repairing deteriorated sidewalks as an integral part of the City's Sidewalk Reconstruction Program, City Engineering also maintains a list of citizen complaints and pursues these repairs in addition to their regular repair program.

Property owners pay 100% of the cost of new sidewalk installation and 50% of the cost for sidewalk repair and replacement. Residential property owners on corners get an additional break in that the City generally covers the cost of 30 feet on the long side and 15 feet on the short side of their property. The City also has a rebate program wherein property owners can receive a $2.00/square foot reimbursement from the City if they have their sidewalk repaired

on their own by a City-approved private contractor.

City Engineering has a backlog of requested sidewalk repairs, and estimates it will take 1-3 years before a requested sidewalk repair will be completed. Requested repairs are basically done in the order they are received, although they might be done out of order if the repair crew is already scheduled to be in a nearby area.

If this 10-year plan is to be implemented, it is critical that future capital budgets provide adequate funding.

Street Trees and Sidewalk Maintenance

In some situations, large street trees have roots near the surface that cause the sidewalk squares to heave unevenly. Most trees have many roots within the top 6-12 inches of soil to gather nutrients for the tree. Some also have a greater tendency to flare out at the base of the trunk to provide stability for the tree. In locations with existing large trees that are causing upheaval problems with an adjacent sidewalk, it does little good to simply reconstruct the sidewalk to alleviate the problem. In these situations it is more constructive to regrade the sidewalk to provide a gradually rising ramp over the roots or re-route the sidewalk.

Large trees are a vital element of livable neighborhoods. Not only do extensive street trees make communities aesthetically pleasing, they help to filter the air and cool the ambient temperature in summer.

In considering how trees and sidewalks interact, there are two situations to consider: how to deal with new plantings and how to deal with trees and sidewalks that already exist.

For new plantings, knowing species characteristics is important in considering how best to plan for interactions between the tree and the sidewalk to minimize maintenance problems with the sidewalk and maximize the tree's health. All large scale trees will eventually cause problems with upheaval if they are close to the sidewalk because they have buttress roots.

This doesn't mean large scale trees shouldn't be planted. Rather, care should be taken to minimize potential future upheaval problems. For example, the tree could be planted further away from the sidewalk so the sidewalk wouldn't be near the buttress roots. Also, for new plantings, placing a 12" vertical metal shield in the ground next to the sidewalk can serve as a barrier so the tree will redirect its roots, but in our climate frost will tend to push up the metal strip [note: this technique should not be applied to existing trees because roots vital to the tree’s survival will likely be severed]. Another alternative perhaps more appropriate for our climate is installing a geotextile fabric below the sidewalk that helps to redirect the roots away from the sidewalk. Further, the design from the start could include plans to make a cut out of the sidewalk or to replace the concrete with pavers set in sand when the tree gets big enough to cause problems with the sidewalk.

For big trees that are next to existing sidewalks, several measures should be considered to maximize the health of the tree and minimize sidewalk maintenance problems. From the tree's perspective, the important issue is to allow the roots to breathe and get water and nutrients. From a sidewalk maintenance perspective, the issue is to minimize damage to the sidewalk

from root upheaval. Several actions can be taken to simultaneously meet the needs of the tree and the sidewalk. First, the sidewalk could be realigned to curve around the tree. Alternatively, a curved section could be cut out of the sidewalk. The Parks Department has implemented this option in several locations including on Atwood Avenue across from Olbrich Park. This option will narrow the effective sidewalk width which is generally a satisfactory solution as long as a clear width of at least 36" is maintained. On sidewalks maintained by Parks, a five to six foot clear area should to be maintained to allow space for their equipment to plow these sidewalks in the winter.

Sidewalk Maintenance Techniques

Several techniques can be employed to repair walkways that have become uneven. If the vertical displacement is less than 3/4 inch, sometimes the edge of the raised square can be beveled to create a less abrupt transition. Where the displacement is greater, several techniques can be employed to alleviate the problem. In some cases, a temporary blacktop wedge may improve a displacement problem. In many situations however, the sidewalk will need to be reconstructed to alleviate problems with vertical displacement. Another technique that some cities have used effectively to raise squares that have settled is mud jacking. However, City Engineering in Madison does not use mudjacking because they report the mudjackers can't compete with the price of slab removal. In addition, City Engineering feels that re-leveling the slab may cause drainage problems (the City tries to maintain a 1-1/4 inch cross pitch from property edge to the street).

Sidewalk Maintenance: Snow Removal

Removing snow from sidewalks, pedestrian connectors, curb cuts, bus pads and medians has significant implications for pedestrians. At best walking is more difficult for anyone trying to walk where snow has not been adequately removed. Some people who normally walk, decide to drive instead of facing the difficult and potentially hazardous walking conditions. Other people still walk, but their travel time is increased when they have to slog through the ice and snow. In addition, their chances of injury greatly increase. Physical therapists report that every winter they treat a significant number of young healthy people who slip and fall on uncleared snow and ice.

At worst, walking becomes impossible for some people where snow has not been adequately removed. People unstable on their feet, on crutches or using a wheelchair are particularly impacted by this situation. Sometimes these people can find another way to get around. However, some of these people are dependent on walking to get around and when they cannot walk, they cannot travel anywhere.

When snow has not been removed from sidewalks, pedestrian connectors, curb cuts, bus pads and medians, pedestrian travel is significantly impacted.

Both property owners and the City have some responsibilities for snow removal. The following describes some of the situations in which each has the responsibility for snow removal.

Property owners are required by City ordinance to remove ice and snow from the sidewalk, and curb cuts on their property by noon the day after the snow stops (MGO 10.28(1)). If there is ice that they cannot remove, they are required to keep it sanded or salted. If they do not do these things, a citizen can report offending properties to the City Building Inspection Unit and the City will clear the snow at the property owners expense. Observations indicate there are many more sidewalks that do not get cleared adequately than are reported to the Building Inspection Unit. Some people are hesitant to turn in their neighbors knowing that they will be ticketed. Other people are simply unclear about where to call.

Observations of how many and how well sidewalks for which property owners are responsible are cleared, indicates that clearing could be improved. Curb cuts and bus stops are also not being adequately cleared.

The City is responsible for snow removal from pedestrian connectors, medians and sidewalks that do not front the street or are on City property (e.g. along parks and greenspaces). Increased miles of bike paths and pedestrian connectors place increasing demands on City resources.

No single agency has enough equipment to do all the snow removal on these facilities, so responsibilities are divided between the Streets, Engineering, Parks and the Water Utility divisions. Streets maintains a map showing which agency is responsible for which areas. Streets is responsible for all bus pads and medians. Parks is responsible for all sidewalks around greenways and park facilities. In addition, they maintain snow removal on the Law Park, Isthmus, Brittingham Park and University Ave. (from the State Office Building to Indian Hills) paths. Engineering's primary responsibilities focus on sidewalks around pumping stations, bridges and sidewalks with railings.

The current Streets Division procedure is to plow heavy traffic routes (main streets, bus routes, access streets to schools, hospitals) after all snow falls. Other areas are plowed if there is at least a two inch accumulation, starting from the city center and proceeding outward. High priority is given to crosswalks near schools, and those identified as being used regularly by persons with disabilities. The City of Madison Disability Rights Coordinator periodically conducts a survey to identify these areas. Crosswalks and corner curb cuts on streets with bus stops are also a top priority. A complete plowing of all streets, paths and sidewalks can take up to three weeks after a snowfall.

The Streets Division does not have appropriate equipment for removing snow from many of the bicycle/pedestrian paths, so responsibility for this snow removal is assigned to other divisions. The Parks Division also has responsibilities for snow removal on some sidewalks and bicycle/pedestrian paths. The Parks Division works on clearing ice rinks, sidewalks and bicycle paths simultaneously. Their top priority is clearing snow from the city-maintained ice rinks. If snow is not promptly removed from the rinks, the ice surface becomes rough and must be redone. Once the rinks have been cleared, the equipment used for these areas focuses

on sidewalks and then bicycle/pedestrian paths. The Parks Division notes that early snowfalls on weekends before the ice rinks are up and running are when most problems occur.

The Parks Division normally has a limited overtime budget, so they plow during regular working hours as much as possible. Therefore, if it snows Friday evening, the Parks Division may not begin clearing snow until Monday morning. In the meantime, the snow often gets packed down by pedestrians and bicyclists over the weekend, making it difficult to remove at all and leaving behind a slippery and uneven surface for pedestrians to negotiate. In 1996, $15,000 was made available to the Parks Division so they could improve their snow removal efforts on bicycle and pedestrian facilities. Assessments of improved service provided by these additional funds vary. Some say they have been impressed by the improved level of service. Others have said there have not been enough early snow falls and snow falls on weekends to notice a difference.

The City of Madison has had increased requests for greater attention to sidewalks, bicycle/pedestrian paths and curb cuts. However, the same crews and equipment are needed for both the paths and the curb cuts and city policies directing the resources available to respond to these requests have not changed. The city ordinance addressing responsibility for snow removal for curb cuts recently changed to transfer responsibility to the property owner. However, the Streets Division has observed in their daily work at some intersections that there has not been a significant change in which property owners do and do not clear these curb cuts.

Sidewalk Inventory

Pedestrians need and want to access the same destinations that users of any other transportation mode do. Therefore, an inventory and analysis of existing pedestrian facilities should consider how well the network of pedestrian facilities provide pedestrian mobility and access throughout the city. Are there areas where no facilities exist? Are there areas where facilities exist, but do not provide direct routes to desired destinations? Do the facilities provide people with disabilities the amenities they require such as curb cuts? Are there difficult street crossings that pose significant barriers to pedestrian travel? Are there areas where facilities exist, but they are in unpleasant environments that do not encourage pedestrian travel?

In many areas of the city, the existing sidewalk and pedestrian connector network provides pedestrians the access and mobility they desire to meet their transportation needs. Of the 1275 miles of frontage along Madison's streets, 333 miles (26.1%) are without sidewalks. Conversely, 942 miles (73.9%) of street frontage in Madison do have sidewalks. In interpreting this figure, it should be noted that streets without sidewalks are not evenly distributed throughout the city. The percentage of street frontage without sidewalks ranges from as low as 3.9% in the central city (aldermanic districts 2, 5, 6 and 8 collectively) to as

high as 40.2% on the city's NE side (aldermanic districts 15 and 17 collectively).[2] Therefore, some areas of the city currently provide much better pedestrian mobility and access than other areas.

Such data were used to develop the City's Ten Year Sidewalk Reconstruction Program and were derived from the City's parcel database. So, although total frontages are available, these data do not readily depict the spatial arrangement of sidewalks to be able to assess how well the existing sidewalks are linked together to form a network that provides pedestrians accessible, convenient, safe and enjoyable travel throughout the city. As part of the planning process to develop the *Pedestrian Transportation Plan*, aerial photographs were used to collect data about the spatial arrangement of walkways throughout the city. Completing and maintaining such a sidewalk inventory would be a useful endeavor for the City to undertake to make Madison an even better place to walk.

SIDEWALK RECOMMENDATIONS

Installation:

3. (HIGH)	City Engineering shall consult with the Wisconsin Department of Transportation on sidewalk matters along Connecting Highways and shall follow the City's sidewalk installation guidelines for these streets as for all other streets within the City of Madison.
4. (CONT)	The Departments of Public Works, Transportation and Planning and Development as well as the Plan Commission, Board of Public Works and Pedestrian-Bicycle-Motor Vehicle Commission shall continue to recommend that sidewalks be installed as an integral component of new developments in accordance with the Madison General Ordinances [16.23(9)(d)(6)].
5. (HIGH)	The Public Works, Transportation and Planning and Development Departments shall review the Madison General Ordinances [16.23(9)(d)(6)] to evaluate the criteria to be considered in determining whether or not sidewalks should be required and recommend changes to the ordinance based on their findings.
6. (MED)	The Departments of Public Works, Transportation and Planning and Development shall review the circumstances of recent sidewalk requirement exemptions for new developments and conditional use redevelopment projects and report their findings and recommendations based on these findings to the Plan Commission, Board of Public Works and the Pedestrian- Bicycle-Motor Vehicle Commission.

[2] Data from the City Engineering Division's 1996 Ten Year Sidewalk Reconstruction Program.

7. (HIGH)	The Departments of Public Works, Traffic Engineering and Planning and Development and the Plan Commission, Board of Public Works and the Pedestrian-Bicycle-Motor Vehicle Commission shall consider the retrofit installation criteria outlined in the *Pedestrian Transportation Plan for Madison, Wisconsin* when making recommendations to the Common Council regarding retrofitting sidewalks in already developed areas.
Design:	
8. (CONT)	All City agencies involved in sidewalk design and construction shall continue to follow MGO 10.06, the City's *Standard Specifications for Public Works Construction*, and the national guidelines published by the Transportation Research Board, the American Association of State Highway and Transportation Officials and the Institute for Transportation Engineers.
Maintenance:	
9. (MED)	The Parks Division and the City Forester shall consider impacts on the walkway when planting new trees along sidewalks or paths.
10. (HIGH)	The Common Council shall strive to provide adequate funding in each Capital Budget so that City Engineering can implement the City's Sidewalk Maintenance Program adopted by the Common Council in 1996.
11. (CONT)	City Engineering and the Streets Division shall continue to be responsive to citizen complaints regarding sidewalks that are in disrepair.
12. (MED)	The Building Inspection Unit shall work to better publicize snow removal expectations and Building Inspection Unit phone number for reporting problem areas.
13. (MED)	The Pedestrian-Bicycle-Motor Vehicle Commission and the Building Inspection Unit shall investigate ways to improve the effectiveness of snow removal on sidewalks, pedestrian connectors and curb ramps.
14. (MED)	The Building Inspection Unit shall prepare a report each year upon the request of the Pedestrian-Bicycle-Motor Vehicle Commission for their review in order to monitor/evaluate the effectiveness of the City's snow removal policies for sidewalks and curb ramps.
15. (MED)	Neighborhood Associations should encourage neighborhood snow removal monitoring and assistance programs.
16. (LOW)	The Streets Division shall investigate the pros and cons of City responsibility for snow removal on sidewalks and should present a report to the Pedestrian-Bicycle-Motor Vehicle Commission.
Inventory:	

17.(HIGH)	Traffic Engineering and City Engineering shall develop and update a sidewalk and pedestrian connector inventory annually to reflect new plats added to the City and areas retrofitted with sidewalks.
18. (MED)	Traffic Engineering and City Engineering shall prepare a report as requested by the Pedestrian-Bicycle-Motor Vehicle Commission summarizing the current status of the sidewalk and pedestrian connector network and the City's retrofitting priorities for the upcoming year, including priorities for implementing pedestrian facilities included in and around newly platted areas.

Walkways: Pedestrian Connectors

Pedestrian connectors are walkways that do not follow a roadway, but instead either provide a convenient connection between two roadways or make a direct connection from the sidewalk network to a final destination. In these ways, they fill in the pedestrian grid where the street network and land uses limit pedestrian access and circulation.

Successful pedestrian connectors possess several characteristics:

Network Connections: They provide connections between dead-end streets or cul-de-sacs, between loop streets, between long blocks, or through open spaces that shorten pedestrian trips over the route options available by the street network.

Destination Connections: They provide convenient connections to land uses such as shopping malls, the downtown, schools, and parks.

Separation from Traffic: They provide continuous separation from traffic with few street or driveway crossings.

This short pedestrian connector across this parking lot enhances pedestrian access from the sidewalk network to Knickerbocker Place on Monroe Street.

Enhanced Street Crossings: Where pedestrian connectors cross streets, the crossings are pedestrian-friendly and might include such features as pedestrian activated signals, median refuges and warning signs for both motor vehicles and path users.

Visibility: Pedestrian safety may be increased when pedestrian connectors are located in close proximity to businesses and houses. Despite fears of some property owners, pedestrian connectors have not attracted crime to adjacent neighborhoods.

Scenic: They are often scenic, offering an aesthetic experience that attracts pedestrians.

Pedestrian Connector Installation Criteria

Pedestrian connectors provide basic linkages and route options for pedestrians that improve access and convenience over options available along the street network. They can maintain a pedestrian grid where the street grid breaks down at a pedestrian scale. In addition, pedestrian connectors can provide a pleasant walking environment separated from traffic.

The need for and desirability of a pedestrian connector is often independent of its length. Connectors can be very short, such as the connectors between Fox Ave. and Hillington Way and between Yosemite Place and Olympic Dr. Some pedestrian connectors on the other hand are quite long such as the Isthmus path. Short or long, these connectors all contribute to an accessible, convenient, safe and enjoyable pedestrian grid.

Pedestrian connectors can be installed in three different types of situations: new development, as an element of a site design, or as a retrofit in already developed neighborhoods or sites. Funding and maintenance issues are other considerations that can play significant roles in decisions about constructing pedestrian connectors. For new plats, developers can be required to complete a pedestrian grid at their sole expense. On the other hand, the City typically pays for retrofitting pedestrian connectors in already developed areas. Maintenance is typically taken care of by the City, except where there is a private path system designed solely to provide internal circulation within the development.

Pedestrian Connector Installation in New Developments

In new developments with cul-de-sacs and loop streets, pedestrian connectors can be integrated into the plat to facilitate maintaining a pedestrian grid where the street grid breaks down at the pedestrian scale. These pedestrian connectors should link cul-de-sacs to neighboring streets and should provide mid-block connections between loop streets and blocks longer than 600 feet where the distance between street intersections does not facilitate direct pedestrian route choice options.

Pedestrian connectors within new developments should be installed at the same time as the sidewalk and street network to establish the pedestrian grid from the beginning. Pedestrian connectors included in the plat to provide convenient connections between the current development and neighboring a yet undeveloped land need not be constructed until the neighboring land is developed. However, the land should be graded and an easement established so that the pedestrian connector can be easily installed when the neighboring land is developed.

Pedestrian Connector Installation as an Element of Site Design

Pedestrian connectors between the sidewalk network and residential, office or commercial buildings provides and enhances pedestrian access to these sites by providing pedestrians with a direct connection between the sidewalk network and the pedestrian's desired destination.

Retrofitting Pedestrian Connectors in Already Developed Areas

Retrofitting pedestrian connectors in already developed areas is often challenging because land is not readily available for the necessary right-of-way. Many types of locations have the potential to be developed to provide pedestrians with these pleasant 'short cuts'. Rail corridors, greenways, parks, and connections between cul-de-sacs, loop streets and adjacent streets or walkways are locations that should be evaluated for possible pedestrian connectors. In evaluating these locations for potential pedestrian connectors, the value of the transportation benefits versus the benefits of the area as an undeveloped open space should be evaluated.

In many cases, however, acquiring the right-of-way for the desired location would involve purchasing land from many individual property owners. To coordinate such acquisitions is challenging at best. At worst it is not feasible. These challenges point to the value of incorporating easements for the corridors into initial plats.

Pedestrian connectors can also be included as an element of a site redesign or refurbishing project. For example, when Westgate Mall was recently refurbished, a pedestrian connector was added to the design that provides pedestrians with a direct connection between Whitney Way and the Mall's main entrance.

Pedestrian Connector Design

Pedestrian connectors are walkways that do not follow a roadway, but instead either provide a convenient connection between two roadways or make a direct connection from the sidewalk network to a final destination. They can be of two basic varieties. They can either simply be a sidewalk that does not follow a roadway, or they can be a multi-use trail intended for both pedestrian and bicycle usage.

Pedestrian connectors that are sidewalks that do not follow the roadway should follow the same design guidelines as those established for sidewalks. On the other hand, pedestrian connectors designed as multi-use trails need to follow different design guidelines because of the anticipated high bicycle and pedestrian use. The American Association of Highway and Transportation Officials (AASHTO) has developed guidelines for bicycle paths that should be followed when designing pedestrian connectors of this type. The AASHTO recommendations suggest these paths should generally be 10-12 feet wide and should have an asphalt surface.

Pedestrian Connector Maintenance

See maintenance guidelines for sidewalks.

PEDESTRIAN CONNECTOR RECOMMENDATIONS

Installation:

19. (CONT) The Public Works, Transportation, and Planning and Development Departments and the Parks Division shall continue to consider rail corridors, parks, greenways and other public access lands for locating pedestrian connectors.

20. (CONT) The Public Works, Transportation, and Planning and Development Departments and the Parks Division shall continue to encourage the Wisconsin DNR to designate and assist in the development of the Capitol City State Trail that will provide urban trail linkages between the Military Ridge and Glacial Drumlin State Bike Trails.

21. (HIGH) In plats for new developments where the public streets and the required sidewalks along the street do not provide an adequate pedestrian scale grid (such as where there are cul-de-sacs and loop streets), the Public Works, Transportation, and Planning and Development Departments shall encourage and require developers to include pedestrian connectors in their plats to maintain pedestrian access and mobility on a pedestrian scale throughout the development.

22. (MED) City Engineering and Traffic Engineering shall identify high priority desirable pedestrian connectors to retrofit in already developed areas for which no easement currently exists, so that the City can make efforts to acquire the right-of-way as opportunities present themselves.

Design:

23. (CONT) When designing pedestrian connectors, the Public Works, Transportation, and Planning and Development Departments and the Parks Division shall continue to follow the sidewalk design guidelines as outlined in the Pedestrian Transportation Plan for Madison, Wisconsin or the American Association of State Highway and Transportation Officials bicycle path guidelines as appropriate depending on the type of pedestrian connector to be installed.

Terraces

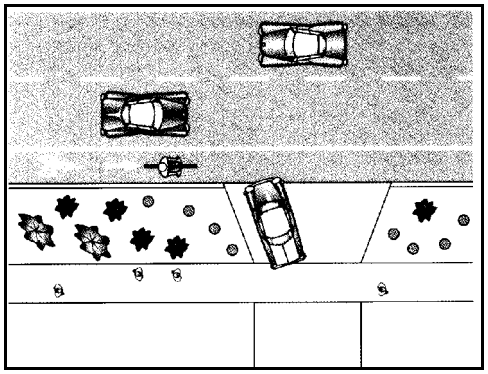
Terrace Design

The terrace is the area between the curb face and the sidewalk. There are many reasons to provide a terrace:

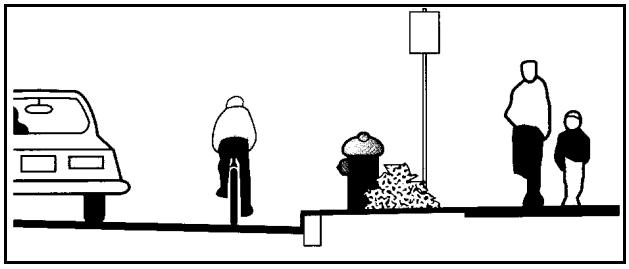
- enhance pedestrian safety and comfort by providing a buffer between the pedestrian and the vehicular traffic on the street;
- provide space for objects such as telephone poles, signal poles, sign posts, parking meters, mailboxes, fire hydrants, and newspaper stands so they do not obstruct the sidewalk;
- an opportunity for aesthetic enhancements such as landscaping and street trees;
- when wide enough, they provide a place for a motor vehicle to wait out of the stream of traffic while yielding to a pedestrian crossing a driveway;
- an enhanced environment for wheelchair users, as the sidewalk can be kept at a constant side slope, with the slope for driveways built into the planting strip section;
- less runoff water, decreasing overall drainage requirements; and
- a place to store snow during the winter.

Typically in Madison the terrace is between seven (7) and 12 feet wide. In residential areas, this area is typically grassy and is the area where street trees are planted. In commercial areas, on the other hand, the terrace is often surfaced with concrete or pavers.

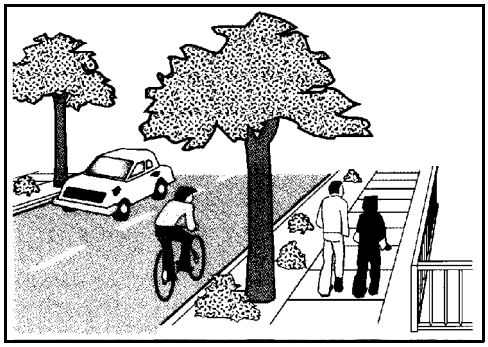
Terraces should be provided between all curbs and sidewalks. Walking directly next to traffic where sidewalks directly abut the curb is uncomfortable and not desirable from a safety standpoint. The only situation in which this should be allowed is if an area is being retrofitted with sidewalks and all possibilities for installing the terrace have been exhausted. The appropriate width for the terrace varies depending on such factors as the vehicular traffic, pedestrian and tree conditions. On low speed, low volume residential streets, or where vehicle parking is allowed on the street, or striped bike lanes are adjacent to the curb to buffer the moving traffic, a smaller terrace may be acceptable. On collectors and arterials without on-street parking or bicycle lanes, terraces should provide sufficient width to buffer pedestrians from vehicles. They should also provide space for street trees, a landscaped planting strip, and sidewalk furniture as appropriate. The extra separation from motor vehicle traffic decreases the impact of road noise, prevents water in puddles from splashing onto sidewalk users and generally increases a pedestrian's sense of security and comfort.



A wide terrace can provide enough room for a motorist to yield out of the stream of traffic to a pedestrian on the sidewalk. [From Oregon Bicycle and Ped Plan, p. 93]



Terraces provide space separate from the sidewalk and street for such objects as sign posts, utility and signal poles, mailboxes, parking meters, and fire hydrants. [From Oregon Bicycle and Ped Plan, p. 92]



A terrace with street trees provides a pleasant buffer between pedestrians and vehicular traffic.
[From Oregon Bicycle and Ped Plan, p. 92]

TERRACE RECOMMENDATIONS

Design:

24. (CONT) All City agencies involved in the design and construction of terraces shall continue to follow the design guidelines established in the City's *Standard Specifications for Public Works Construction*.

Street Crossings

Street crossings are often the most difficult part of a walking trip. At the public meetings held in conjunction with developing this plan, various issues related to crossing streets were mentioned more often than any other issue.

The ease or difficulty of street crossings is often influential in the decision about whether or not to walk for a particular trip. For example, the Madison Metropolitan School District in conjunction with the City of Madison has decided that it is reasonable to expect elementary school students to walk up to 1.5 miles to get to school. Therefore, students living farther than 1.5 miles from school are bused and those living closer are expected to find their own way to school. Often these students walk. However, in some cases students are bused to school although they live less than 1.5 miles away. Twenty-two of the 29 public elementary schools in Madison transport some students less than 1.5 miles from school due to either hazardous street crossings, lack of sidewalks or hazardous walking conditions. Of these schools, 15 (68.2% of schools busing students less than 1.5 miles) specifically bus the students because of hazardous crossings. In addition, approximately 50 adult school crossing guards assist children in crossing streets. In addition, many parents drive their children to school due to concerns about street crossings.

Evaluating existing street crossings and designing new ones is a complicated task because, unlike walkways, street crossings by definition deal with the interaction between pedestrians and motorists. Typically treatments that have a positive impact on one mode have a negative impact on the other. As a result, designing street crossings to balance needs/desires of all users is more difficult and controversial than walkway design.

Many variables enter into determining how well a street crossing provides for accessible, convenient and safe pedestrian travel. Evaluating street crossings for pedestrian safety and convenience is also complicated because these variables operate both within spatial and temporal dimensions. Further, all the variables are interdependent. For example, short crossing distances are a higher priority for pedestrians as traffic volume increases.

Because of the controversial nature of evaluating and designing successful pedestrian crossings, it is useful to first consider some of the basic characteristics of a successful crossing before exploring the specific variables that influence how easily pedestrians can cross the street. In general, several factors should be considered in evaluating and designing street crossings for pedestrians: frequency of crossing opportunities, pedestrian delay, and minimizing pedestrian exposure to conflict with motorists.

Frequency of Crossing Opportunities

People prefer not to travel out of their way unless it is necessary, no matter their mode of travel. Pedestrians are no exception. A successful pedestrian transportation system will provide pedestrians with options for direct routes. One aspect of direct routes is where walkways are provided. An equally important aspect is opportunities to cross the street. The distance between comfortable opportunities to cross the street should be minimized. In older neighborhoods with grid street patterns, blocks are typically 300 feet long, so frequent

crosswalks are automatic. On the other hand, in some newer developments with curvilinear street patterns blocks are frequently 600-900 feet long. In these areas, depending on traffic conditions, adequate opportunities to cross the street can be provided through a combination of crosswalks at corners, midblock crosswalks, opportunities to cross midblock without a crosswalk, signalized intersections and grade separated crossings.

Where blocks are short, crosswalks at corners provide frequent crossing opportunities. When traffic is heavy and when intersections are signalized, crossing at these corners sometimes provides the only opportunity to cross. In corridors like these, unsignalized intersections between signals can be problematic for pedestrians trying to cross the street because motorists often fail to yield to pedestrians waiting to cross the street at these crosswalks.

Midblock crosswalks can help to decrease the distance between comfortable opportunities to cross the street. Midblock crosswalks are most often installed where large numbers of pedestrians wish to cross the street midblock to reach a particular destination such as a school, park or commercial area. For example, a midblock crossing across Midvale Boulevard provides children a direct and convenient route to Midvale Elementary School.

Opportunities to cross the street midblock without a crosswalk can also increase the number of opportunities a pedestrian has to cross the street, thereby enhancing the pedestrian's opportunity to pursue a direct route. Crossing midblock outside a crosswalk is legal so long as it is not in between two consecutive intersections controlled by signals. The important difference to note between crossing the street in a crosswalk and crossing midblock without a crosswalk is that the pedestrian's rights and responsibilities are different in these two situations. Whereas vehicular traffic has a duty to yield to pedestrians crossing in a crosswalk, pedestrians must yield the right of way to vehicular traffic when they are crossing midblock outside a crosswalk. Therefore, for crossing midblock without a crosswalk to enhance a pedestrian's opportunities to cross the street, there must be frequent adequate gaps in traffic to allow them to cross.

Pedestrian Delay

Pedestrian delay occurs when a pedestrian must wait for an opportunity to cross the street safely, that is, without conflict with motor vehicles. Pedestrian delay occurs at signalized and unsignalized locations and at midblock crossings.

At traffic control signals with pedestrian signals, legally pedestrians may begin to cross the street when the pedestrian signal indicates WALK. Pedestrian delay occurs when pedestrians wait for the next WALK signal to cross. Therefore, the signal cycle length, or time between the beginning of one green signal and the next, influences the extent to which the signal delays pedestrians. Typical signal cycles in Madison range between 50 and 80 seconds during off-peak hours and between 80 and 110 seconds during peak hours. Studies in Boulder, Colorado have shown that the shorter the pedestrian delay, the more likely pedestrians are to obey the signal. Pedestrians encounter additional delay when motorists fail to yield to pedestrians in the crosswalk. If the pedestrian delay is too long and the pedestrian feels there are adequate gaps in traffic to cross the street before the signal changes, the pedestrian is more likely to disobey the signals. Observations indicate that pedestrians in Madison typically cross with the

pedestrian signal when there are no adequate gaps in traffic to cross, but if there is a break in traffic they will readily cross against the pedestrian signal.

At unsignalized crosswalks, pedestrian delay occurs when motorists fail to yield to the pedestrian and the pedestrian must wait for an adequate gap in traffic before crossing. The MUTCD (4C-5) suggests that 60 or more gaps per hour is a reasonable target to aim for. However, a Boulder, Colorado study indicates that pedestrians are willing to wait an average of only 15 seconds. After waiting about 15 seconds, the study notes that most pedestrians will cross in a smaller gap than earlier gaps that were rejected. Pedestrian delay at unsignalized locations can be reduced by adding a median refuge island or by artificially creating gaps in traffic through adjustments to the signal timing at nearby intersections.

Ideally, adequate gaps should occur frequently enough that pedestrians are not tempted to cross in gaps that are too short to be able to cross safely and therefore more likely to lead to conflict with motorists.

Minimizing Exposure During Crossing

Pedestrians want to be exposed to potential conflict with motorists as little as possible. Generally, for street crossings, this means spending as little time in the street as possible. One way to accomplish this is through grade separated crossings. More common approaches are to minimize the pedestrian crossing distance at grade and/or to manage pedestrian and vehicular traffic signals to minimize conflicts between pedestrians and motorists. Minimum pedestrian crossing distance is achieved through a variety of tools: narrow streets, fewer traffic lanes, small curb radii, perpendicular curb ramps, curb extensions and refuge islands. Signal management tools include leading pedestrian signals, exclusive pedestrian crossing time, and separate timing for different intersection legs depending on pedestrian and vehicular traffic flows.

As outlined above, successful pedestrian crossings are defined by three broad principles: frequent crossing opportunitites, minimum delay, and minimum exposure to potential conflict with motorists. The following sections explore several categories of variables that come together to influence these broad principles: the interface between the walkway and the street - the street corner; spatial interactions between pedestrians and motorists; temporal interactions between pedestrians and motorists; and special pedestrian crossing situations.

Street Corner: Interface Between the Walkway and the Street: Curb Ramps

Curb ramps make walking easier for all pedestrians by providing a gradual transition between the sidewalk level and street level. For pedestrians in wheelchairs, using walking assistance devices or pushing or pulling a wheeled device such as a baby stroller or wagon, curb ramps mean the difference between an accessible and inaccessible route. These pedestrians typically cannot negotiate curbs without ramps and so where no ramps exist, they are unable to cross the street.

Curb Ramp Installation Criteria

Curb ramps facilitate pedestrian travel by providing a sloped transition between the height of the sidewalk and the height of the street. Originally, they were designed and installed to facilitate travel for wheelchair users. Today however, it is well understood that many people in addition to wheelchair users benefit from curb ramps, including anyone pushing a baby stroller, pulling a wagon, traveling on roller skates, or pushing or pulling any other wheeled device. Therefore, it is beneficial to provide curb ramps at all street corners.

Curb ramps make walking easier for all pedestrians.

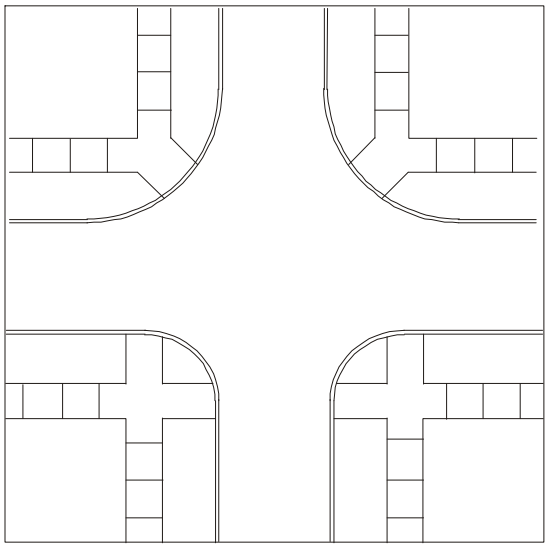
Curb ramps are routinely installed during new construction at all intersections where there are sidewalks in Madison. In addition, the City continues to retrofit existing corners with curb ramps. Sometimes these are included as part of a street reconstruction project. When funds permit, individual curb ramps are occasionally retrofitted as a stand alone project. City Engineering estimates that 25 percent of intersections in the City have curb ramps missing on one or more of their corners. Where curb ramps either do not exist or are substandard, the City routinely retrofits corners when it goes into a neighborhood for the sidewalk reconstruction program.

Curb Ramp Design

Curb Ramp Design: Perpendicular vs. Diagonal Curb Ramps

Curb ramps can be either perpendicular or diagonal. A street corner with perpendicular curb ramps provides a curb ramp that is at a right angle to the street for each crossing direction. A diagonal curb ramp provides a single curb ramp to serve two street crossing directions.

Perpendicular curb ramps are more desirable than diagonal curb ramps for pedestrian crossings. Perpendicular curb ramps provide a direct path across the intersection, maximizing convenience and minimizing delay and exposure to conflicts with vehicular traffic. Also, pedestrians are more likely to be able to stay within the crosswalk if perpendicular curb ramps are provided. In addition, perpendicular curb ramps make it possible for pedestrians to be able to clearly indicate their intended travel direction while waiting to cross the street. Therefore, whenever possible, it is desirable to design street corners so that perpendicular curb ramps can be installed.

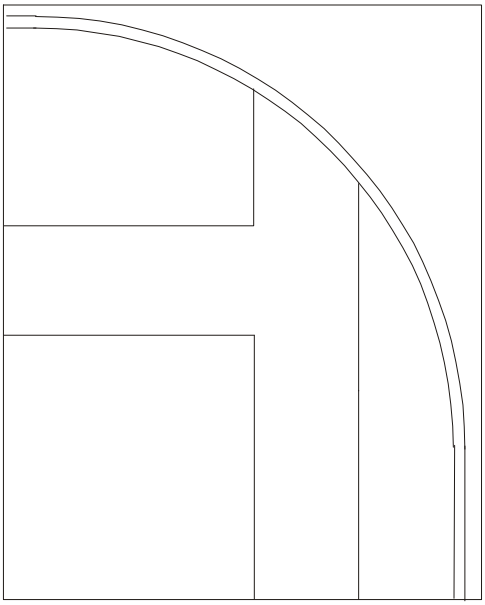


A street corner with perpendicular curb ramps (bottom two corners in diagram) provides a curb ramp that is at a right angle to the street for each crossing. A diagonal curb ramp (top two corners in diagram) provides a single curb ramp to serve two directions.

Where curb radii are large, diagonal curb ramps can provide a minimum cross slope more successfully than a perpendicular curb ramp. As curb radius standards have increased in most communities, diagonal curb ramps have become the norm. However, diagonal curb ramps present several problems for curb ramp users. Visually impaired people find it difficult to orient themselves across an intersection with diagonal curb ramps because diagonal curb ramps direct them into the middle of the intersection. Also, at intersections with heavy pedestrian traffic and diagonal curb ramps, wheelchair and other curb ramp users have to cross the flow of pedestrian traffic twice - once entering and once exiting the intersection. Another problem with diagonal curb ramps for many curb ramp users is that sometimes pedestrians using the diagonal curb ramp are expected to travel along the edge of the roadway to the crosswalk. This expectation becomes problematic when the seam between the gutter and the asphalt is not well maintained.

Curb Ramp Design: Running Slope and Cross Slope

Other curb ramp design issues to consider are the running slope and the cross slope of the curb ramp. The running slope of a curb ramp is the slope in the direction of travel and should not exceed 1:12. When the slope exceeds this maximum, the curb ramp is difficult to negotiate, especially for people using manual wheelchairs or pushing a stroller. The curb ramp on the northeast of the intersection between Atwood Avenue and Cottage Grove Road is an example of a curb ramp that is difficult for some pedestrians to negotiate due to its steep slope.



This curb ramp will be difficult for many wheelchair users to negotiate due to its cross slope

Cross slope refers to a slope that runs across the running slope of the curb ramp. Cross slopes can cause wheelchairs to become unstable and if too extreme can cause them to tip over. A pedestrian with a mobility impairment may be using a sport or standard manual chair, a 3-wheeled power scooter,

a standard power chair or a large custom model capable of many seating adjustments. Each requires different features of a curb ramp for maximum usability. For example, large, heavy, power driven wheelchairs cannot accomplish fine maneuvers in tight spaces, but they are very stable on dry surfaces and can traverse a steep slope with little difficulty - as long as their power supply is available. On the other hand, small, lightweight manual chairs can maneuver tightly but are very unstable on cross slopes and are easily tipped backwards where ramp slopes are extreme. Three-wheeled power scooters with control tillers have large turning radii because of their longer wheelbases and will be unstable on compound slopes because of their higher seats and narrow width.

Cross slopes result from several situations and should be avoided whenever possible. One possibility is the way the ground is graded. Another way is when the curb ramp is not perpendicular to the curb throughout its width. This can be a particularly significant issue with larger curb radii. When a curb ramp is not perpendicular to the curb face, one edge of the curb ramp extends farther into the intersection than the other. Since the curb ramp reaches the road level at the curb face edge, one side of the curb ramp will reach the road level before the other, thus resulting in a cross slope across the curb ramp.

Curb Ramp Design: Width

Curb ramp width is another design issue to consider. The Americans with Disabilities Act suggests that curb ramps should be 36 inches wide minimum, exclusive of the flared sides. Wisconsin State Statutes (66.616) define that curb ramps shall be at least 40 inches wide. When narrower than 36 inches, wheelchair users find the curb ramp either difficult or impossible to negotiate. The curb ramps at the intersection between Monroe, Odana and Nakoma are some of the first ones that the City installed and are narrower than is generally considered desirable today.

Curb Ramp Design: Surface Texture

In addition to slope and width, surface texture is another important curb ramp design consideration. Typically, in Madison curb ramps are textured with a diamond cross hatch pattern. This texture helps improve the slip resistance of the surface and provides a tactile warning for visually impaired people.

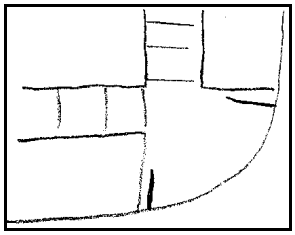
Curb Ramp Design: General Discussion

Existing guidelines, including UFAS and the ADA interim final rule for Chapter 14, support perpendicular curb ramps and a cross slope less than two percent. However, achieving this ideal is possible only in situations where curb radius, combined sidewalk and terrace width, and the topography are ameniable to this construction. Often, one or more design constraints mean that alternative designs must be considered. National guidelines as well as Madison's standard specification drawings provide little guidance for adapting the ideal to these situations. Flexibility to exercise engineering judgement is important for adapting to specific situations, however some guidance with respect to design criteria and suggested design details

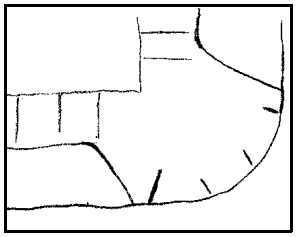
would be useful for maximizing the chances that all pedestrians will be able to successfully use the resulting curb ramp.

Wheelchair users indicate several general design criteria that should be taken into account as guidelines are developed for ways to adapt curb ramp designs to provide a travel path that avoids cross slope problems without installing a diagonal curb ramp. Since different types of wheelchairs have different limitations for handling running and cross slopes, the curb ramp design should allow the curb ramp user several options for how to proceed up or down the ramp. Much of this hinges on providing adequate space to allow the pedestrian to maneuver perpendicular to any cross slope. It is also desirable if the curb ramp design allows a placement that provides the pedestrian with as direct a line of travel as possible. Several design concepts have been suggested as possible ways to overcome conflicting issues between perpendicular curb ramps and cross slopes (see concept drawings below): a depressed corner, a modified perpendicular curb ramp, and a flared curb ramp design. Ongoing discussions to develop improved curb ramp design guidelines should consider these as well as other possible design solutions.

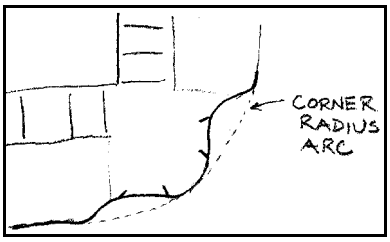
As described above, design of the curb ramp itself is important. It is also important to consider how they combine together to guide the pedestrian's path of travel. The new curb



A depressed corner provides a variety of travel path options to over come the cross slope. Orientation for visually impaired pedestrians and motorists cutting the corner should also be considered.



A flared extension between the sidewalk and the curb ramp allows the pedestrian flexibility in travel path to counteract any cross slope.



By modifying the curvature of the curb, it is possible to install perpendicular curb ramps without any cross slope. Drainage at the base of the curb ramp needs to be considered.

ramps across the main entrance into Westgate on Whitney Way could have provided pedestrians with a direct travel line, but instead guide them in a zig zag across the median refuges. In addition, the curb ramps in the medians on John Nolen Drive where it intersects with Olin Avenue do not line up to provide pedestrians with a straight line of travel across the street. These and other examples suggest curb ramp design would benefit from a better

understanding of the critical variables to consider and how these variable interact to result in "good" and "bad" curb ramps.

Some of the factors that this more detailed understanding of curb ramp design should address are outlined in AASHTO's *A Policy on Geometric Design of Highways and Streets.* These guidelines recommend understanding how several variables impact curb ramps and their ability to provide adequate space to allow pedestrians to move perpendicular to any cross slope:

1. Sidewalk width;
2. Sidewalk location with respect to the back face of the curb;
3. Height and width of the curb cross section;
4. Curb radius and length of curve along the curb face;
5. Angle of street intersection;
6. Planned or existing location of sign and signal control devices;
7. Storm water inlets and public surface utilities;
8. Possible sight obstructions;
9. Terrace width; and
10. Roadway grade.

The curb ramps across the main entrance into Westgate on Whitney Way could be improved to provide a straighter line of travel for pedestrians.

Curb Ramp Maintenance

In general, maintenance practices for curb ramps should follow the same procedures established for walkways. However, there are a couple special maintenance issues to consider. Settling can make drainage away from the base of the curb ramp a problem. Pedestrians naturally do not want to step in the potentially deep puddle that forms when curb ramps do not drain properly. Of particular concern for wheelchair users is that these puddles can hide pot holes. For people using manual wheelchairs, an additional concern is potentially sharp pieces of road debris that may get caught on their wheels and cut their hands.

CURB RAMP RECOMMENDATIONS

Installation:

25. (CONT) City Engineering shall continue its efforts to retrofit intersections with curb ramps where they currently do not exist.

26. (CONT) City Engineering shall continue to require developers to install curb ramps at all street corners in new developments.

Design:

27. (HIGH)	When curb ramps are installed or reconstructed, City Engineering shall, whenever possible, design the street corner to be able to provide curb ramps that minimize the pedestrian crossing distance and permit all pedestrians to be able to negotiate the curb ramp perpendicular to its slope.
28. (MED)	The Transportation, Public Works and Planning and Development Departments shall work with the Citizens Advisory Committee on People with Disabilities and the US Architectural and Transportation Barriers Compliance Board to improve the City's guidelines for curb ramp design.
29. (LOW)	Traffic Engineering and City Engineering shall research developing a methodology for evaluating accessibility of curb ramps, so curb ramps that are inadequate can be identified and replaced during street and/or sidewalk reconstruction.

Maintenance:

NOTE: See recommendations listed under sidewalk maintenance section.

Street Corner: Interface Between the Walkway and the Street: Curb Extensions

Curb Extension Installation Criteria

Curb extensions are also known as bulb outs or neck downs. Just as the name implies, the curb is extended into the street from its usual position to create a bulbed out sidewalk area that narrows the street. As such, curb extensions can be an effective tool for reducing the crossing distance for pedestrians. Curb extensions can be applied to one or more corners of an intersection, and therefore can impact one or both sides of a crossing on one or more legs of an intersection.

Curb extensions can be an effective tool for reducting the crossing distance for pedestrians.

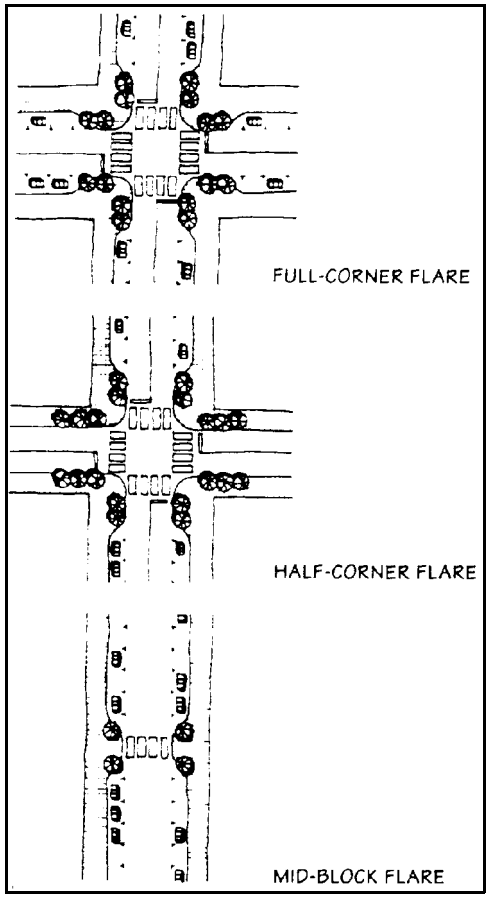
From a pedestrian perspective, curb extensions are beneficial because they:

- Shorten the distance pedestrians must cross;
- Provide better visibility than standard corners for pedestrians to see and be seen;
- Provide space for benches and other street furniture; and
- May reduce vehicle speeds.

In Madison, curb extensions have been installed in several locations including the side streets off the Capitol Square. Curb extensions have also been installed at several intersections between a residential and arterial street. In these situations, the curb extension helps to alert drivers that they are now entering a residential area and that they are expected to drive accordingly.

Curb Extension Design

There are several design issues related to curb extensions to consider. Visibility is one of the important reasons why curb extensions are installed. Conflicts between pedestrians and motorists at intersections are less likely to occur where motorists can see pedestrians better and pedestrians can see motorists better. Curb extensions are particularly helpful in accomplishing these goals, especially in areas where on-street parking is allowed. In these areas, the curb extension allows the sidewalk area to be extended out to the edge of the parked cars so that the pedestrians and motorists do not have to rely on looking through or around the parked cars to see each other. How far the curb extension extends along the curb is another design issue to consider. The extension should be at least as long as the sidewalk plus terrace that approaches it. Curb extensions can be made longer and/or wider to accommodate features such as street trees, street furniture and bicycle racks. Finally, the curb radius is as important a consideration for curb extensions as it is for regular street corner design. Although curb extensions are intended to shorten the pedestrian crossing distance, if they are designed with large curb radii, this benefit is greatly reduced. Larger curb radii also make it more difficult to install perpendicular curb ramps.



When designing curb extensions, visibility between pedestrians and motorists, how far the curb extension extends out and along curb, and curb radius are several design criteria to consider.
[From New Jersey DOT Pedestrian Guidelines, p. 30]

Curb extensions can be installed in conjunction with other street crossing treatments to provide for accessible, convenient, safe, and enjoyable pedestrian travel. Ladder crosswalk markings and a colored, textured, or raised crosswalk can further enhance the visibility and prominence of the pedestrian crosswalk. In addition, pedestrian scale lighting, trees and other traffic calming techniques can effectively extend the impact of a curb extension along a corridor.

Curb Extension Maintenance

Maintenance practices for curb extensions should follow the same procedures established for sidewalks.

CURB EXTENSION RECOMMENDATIONS

Installation:

30. (MED) City Engineering and Traffic Engineering shall consider installing curb extensions on streets where there are high pedestrian volumes or other special design situations in order to enhance the pedestrian crossing, to encourage appropriate vehicular speeds at neighborhood entrances, and to shorten the crossing distance for pedestrians.

Design:

31. (LOW) Traffic Engineering and City Engineering shall review current design guidelines for curb extensions and make appropriate recommendations for improving curb extension design to enhance pedestrians' ability to see and be seen and shorten crossing the pedestrian crossing distance.

Maintenance:

NOTE: See recommendations listed under sidewalk maintenance section.

Street Corner: Interface Between the Walkway and the Street: Curb Radii

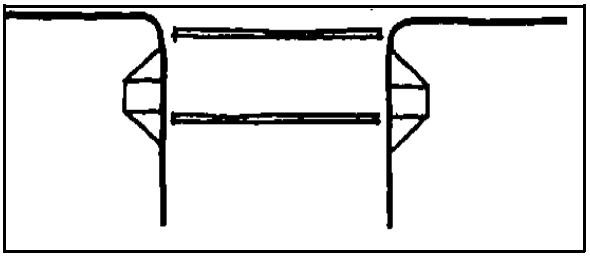
Curb Radius Design

Curb radius measures the sharpness of the corner formed by two intersecting streets. Specifically, it refers to the radius of the circle formed by the curve of the curb at the corner. The curb radius interrelates with street width to affect the motor vehicle's path and speed as well as the crossing distance for the pedestrian. The curb radius, street width and pedestrian crossing should be designed to serve the expected mix of uses, included emergency, service and delivery vehicles.

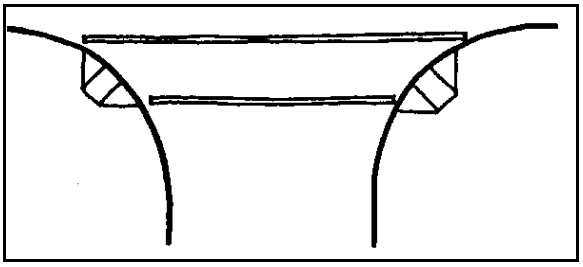
Like all street crossing issues, curb radius design must balance motorist and pedestrian needs. Especially on arterial streets, large curb radii are often recommended to enable large vehicles to be able to turn onto the cross street without encroaching into the on-coming traffic lanes and to reduce the differential speeds between turning traffic and through traffic in order to

reduce the potential for rear end collisions.

Both larger curb radii and diagonal curb ramps lead to longer street crossing distances for pedestrians. Therefore, from a pedestrian perspective not only are narrow streets desirable, but also small curb radii and perpendicular curb ramps.



Small curb radii minimize the pedestrian crossing distance. [From Portland Ped Guidelines, p. D-5]



Large curb radii result in long pedestrian crossing distances. [From Portland Ped Guidelines, p. D-5]

Traditional neighborhoods usually have streets with curb radii in the range of 15 to 20 feet and perpendicular curb ramps. At the same time, in traditional neighborhoods, the streets are narrower and the terraces are wider. As a result, in general, traditional neighborhoods tend to have more pedestrian friendly crossings than contemporary suburban neighborhoods.

In these neighborhoods, corner lots typically do not have a property line radius for sight distance and for the installation of sidewalk to keep people from 'cutting the corner.' Residential neighborhoods designed over the last 40 years have 25 to 30 foot curb radii and diagonal curb ramps. In 1997, City Engineering began to use 20 foot curb radii for all local residential streets.

On-street parking also impacts the effective curb radius. When cars are parked near the corner, the effective curb radius is defined by the edges of the cars rather than the curb face. This effective curb radius is substantially larger than the curb radius at the curb face and may therefore allow for smaller curb radii.

CURB RADIUS RECOMMENDATIONS

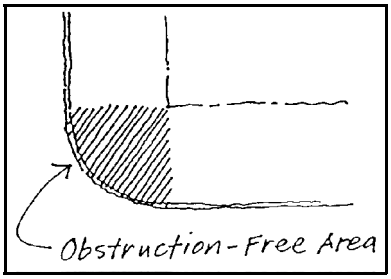
Design:

32. (HIGH) Traffic Engineering and City Engineering shall increase emphasis on pedestrian issues when selecting curb radii for street corner designs.

Street Corner: Interface Between the Walkway and the Street: Obstruction-Free Areas

Obstruction-Free Area Design

The obstruction-free area of a street corner is the space between the curb and the lines created by extending the inside edge of the sidewalk to the curb face. Curb ramps are located in this area and pedestrians wait in this area to cross the street. Because this area needs to accommodate pedestrians waiting to cross the street while still allowing other pedestrians to pass by, it is important that this area be designed and maintained to be free as possible from obstructions. Keeping this area free from obstructions is also important in terms of how well motorists can see pedestrians waiting to cross the street and how well pedestrians can see gaps in traffic adequate for crossing. Signal poles, street lights, telephone poles, hydrants, trees, benches, signs, controller boxes, newspaper boxes, and other vertical elements should not be located within the obstruction-free area. Exceptions to this include low posts for pedestrian-activated signal controls.



The obstruction-free area of a street corner is the space between the curb and the lines created by extending the inside edge of the sidewalk to the curb face. [From Portland Ped Guidelines, p. A-14]

The area included within the obstruction-free area decreases as the combined width of the terrace and sidewalk decreases. Where the obstruction-free area, as defined above, is particularly small due to the combined sidewalk and terrace width, it may be desirable to expand the obstruction-free area beyond these boundaries. Therefore, if the terrace is narrow or non-existent, the obstruction-free area will be particularly small and obstructions will be particularly problematic. On the other hand, where the terrace is wider, the corner area is bigger and space is at less of a premium to maintain functionality. Some obstructions are likely to be more problematic for pedestrian travel than others. For example, traffic signal and street light poles placed at the far edge of the obstruction-free area are likely to cause fewer visibility problems than if these objects were placed at the apex of the corner.

Madison does not currently follow a written policy of providing obstruction-free areas. Power/telephone poles and fire hydrants are the objects that most commonly encroach on this space. Trade offs between pedestrian needs and needs for locating some of these items in the obstruction-free area need to be researched further to make recommendations about City guidelines for locating items in this area.

OBSTRUCTION-FREE AREA RECOMMENDATIONS

Design:

33. (LOW) Traffic Engineering and City Engineering shall continue to research the issue of obstruction-free areas further and make recommendations about improving how these areas are designed.

Spatial Interactions Between Pedestrians and Motorists

One of the mechanisms that is used to manage interactions between pedestrians and motorists at intersections is to control the spaces they occupy. Facilities can either provide for pedestrians to cross grade-separated or at-grade. The spaces that the pedestrians and the

vehicles occupy are completely separated for grade-separated crossings. These crossings therefore minimize conflict between the pedestrians and vehicles.

However, most often facilities are designed for pedestrians to cross at grade, because grade-separated crossings are very expensive and require increased effort by pedestrians, so pedestrians will only use them if they perceive the trade-off between safety and convenience to be worth the extra effort (see following section for discussion of situations where grade-separated crossings are successful).

Several keys to successful at-grade crossings are to define the spaces where pedestrians are expected, to define right-of-way rules for these areas, and, in some cases, to provide pedestrians a safe place to seek refuge from motorists midway across the street. The space in an intersection where motorists expect to encounter pedestrians is in the crosswalk. The Wisconsin State Statutes [340.01(10)] and the Madison General Ordinances (12.01) define a crosswalk (except where signs have been erected by local authorities indicating no crossing) as:

"(a) *Marked Crosswalk*: any portion of a highway clearly indicated for pedestrian crossing by signs, lines or other markings on the surface; or

"(b) *Unmarked Crosswalk*: in the absence of signs, lines or markings, that part of a roadway, at an intersection, which is included within the transverse lines which would be formed on such a roadway by connecting the corresponding lateral lines of the sidewalks on opposite sides of such roadway or, in the absence of a corresponding sidewalk on one side of the roadway, that part of such roadway which is included within the extension of the lateral lines of the existing sidewalk across such roadway at right angles to the center line thereof, except in no case does an unmarked crosswalk include any part of the intersection and in no case is there an unmarked crosswalk across a street at an intersection of such street with an alley."

Spatial Interactions Between Pedestrians and Motorists: Crosswalk Markings

Crosswalk Marking Installation Criteria

Crosswalk markings at mid-block pedestrian crossings establish pedestrian right-of-way where motorists would have the right-of-way without the pavement markings.

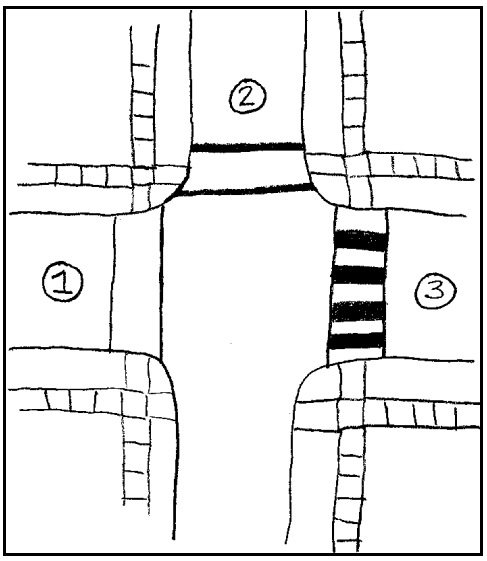
Marked crosswalks indicate to pedestrians the desirable route for crossing the street and remind turning drivers about potential conflicts with pedestrians. In Madison, crosswalks are marked and signed in conformance with the latest edition of the MUTCD (3B-18) and the Wisconsin Vehicle Code.

Not all crosswalks warrant pavement markings. At uncontrolled intersections between narrow residential streets with little vehicular traffic, for example, there is little question about the most desirable pedestrian route across the intersection and as an uncontrolled intersection, motorists should be particularly aware of all traffic entering the intersection, including pedestrians. Therefore, the benefits of marking the crosswalk at this location are limited. In addition, consideration should be given to the MUTCD suggestion that marked crosswalks lose their effectiveness when crosswalks are marked indiscriminately.

Marked crosswalks are particularly desirable in several situations. One clear distinction is signalized and unsignalized intersections. Because of the more complicated nature of signalized intersections with respect to traffic movements, marking crosswalks is beneficial at these locations. The value of marking crosswalks at unsignalized intersections is more variable. At unsignalized intersections where at least one of the intersecting streets is an arterial or collector street, crosswalks will often be marked on both the residential and major streets. The other location where crosswalks are marked is to designate a legal pedestrian right-of-way where there would not be one without the pavement markings. This situation occurs where mid-block crossings are provided.

As expected given the above warrants, marked crosswalks in Madison are concentrated on arterial and collector streets. In residential areas, for the most part, the only marked crosswalks delineate mid-block crossings or draw attention to locations where pedestrian connectors cross the street, which are typically mid-block. On arterial and collector streets, crosswalks are marked at all signal and stop sign controlled intersections. Crosswalks at uncontrolled intersections are marked selectively based on expected pedestrian volumes and travel routes.

Crosswalk Marking Design



In Madison, pavement markings for crosswalks are generally one of three styles: 1) six-inch parallel white lines, 2) 12-inch parallel white lines, or 3) ladder markings.

Whenever possible, crosswalk markings should be located to allow pedestrians to travel in a straight line from the sidewalk across the intersection. The pedestrian crossing path generally should be perpendicular to the travel direction of the traffic it crosses to minimize exposure and therefore the chances of conflict. Where a diagonal curb ramp is provided, crosswalks should be marked in such a way as to allow pedestrians to remain within the marked crosswalk while crossing the street.

In Madison, pavement markings for crosswalks are generally one of three styles. Most commonly crosswalks are marked using two parallel six inch wide white lines. Generally this type of a marking is used at signalized and stop-controlled intersections. In some locations, including some school crossings, slightly more emphasis is given to the crosswalk by using 12 inch lines instead of six inch lines. This type of pavement marking is also used for complicated intersections with high volumes of traffic where pedestrians may be less visible to motorists in the midst of the vehicular movements. The most visible crosswalk marking used in Madison is the ladder or zebra crosswalk, defined by a series of wide parallel bars extended across the street parallel to the curb. Ladder crosswalks are typically installed at school crossings, mid-block crossings and crossings across arterial and collector streets at uncontrolled intersections where high volumes of pedestrians are present.

Pedestrians with visual impairments are a special consideration in trying to mark crosswalks to ensure that all pedestrians can stay within the markings while crossing the street. Visually impaired pedestrians may be crossing near, but not within, a crosswalk because they have not been able to determine the exact location or direction of the crosswalk. San Diego and Sacramento have, for some years, had tactile guide strips in selected intersections in which it has proved to be particularly difficult for pedestrians who are visually impaired to cross within crosswalks. Richard Skaff in San Francisco has conducted some research on materials for tactile paths.

Audible traffic signals, if they are loud enough to be heard across the street, may provide good directional information but nonetheless do not assure that visually impaired pedestrians are able to stay precisely within crosswalks. Unfortunately, loud audible traffic signals are considered a public nuisance in many locales, and many available audible signals are not highly directional. A directional signal has been developed in Montreal that uses a brief melody that alternates from one side of the street to the other, during the crossing cycle. Information is available from Agathe Ratelle (montem@CAM.ORG).

Another approach to providing information about the location and direction of crosswalks is the Talking Signs system which is being incorporated into pedestrian signals in San Francisco. The technology is comprised of an infrared transmitter that sends recorded voice messages to receivers in the hands of users. The receivers can be used with or without earpieces. A message, which can be heard from the receiver for some distance down the block, includes the name of the perpendicular street, the 100 block, and the direction the person is traveling. When the user is at the corner, and standing within the crosswalk, an additional message indicates the status of the signal cycle. Talking Signs technology is a private listening system, and therefore does not become noise pollution to people who do not need this information in audible form.

Smith-Kettlewell Eye Research Institute, San Francisco (Dr. William Crandall bc@skivs.ski.org) is currently conducting research to see whether it is desirable to use an additional channel on Talking Signs receivers to provide more descriptive information about intersections such as layout and traffic control. For instance, it could tell how many lanes wide the crossing is, whether there is an island, whether the signal cycle is long enough to permit a full crossing, or whether the system is designed for pedestrians to stop on the island, activate another pedestrian signal, and wait another cycle to complete the crossing. It could also say whether right-on-red is permitted and whether there is a separate left turn cycle.

Pavement Marking Maintenance

Crosswalks can be marked with one of several materials: latex paint, preformed cold tape, preformed hot tape, epoxy or thermoplastic. Madison currently uses all of these materials except for thermoplastic. A challenge that Madison faces is the impact that winter sand, salt and snow plow blades have on these pavement markings. There is a trade off between cost and how well the markings hold up through the winter. Paint is the cheapest material, but it also is very poor in withstanding Madison's winters. The City would like to experiment with the thermoplastic material. It is more expensive than paint, but several cities in Illinois that use the material report that it holds up well in winter weather.

CROSSWALK MARKING RECOMMENDATIONS

Installation:

34. (CONT) Traffic Engineering shall continue to follow the state and national guidelines to determine where crosswalks should be marked.

Design:

35. (CONT) Traffic Engineering and City Engineering shall continue to design crosswalk markings according to their present guidelines.

36. (LOW)	Traffic Engineering and City Engineering shall continue to work with the Disability Rights Coordinator and the visually impaired community to improve crosswalk and intersection designs including consideration of audible pedestrian signals to facilitate visually impaired pedestrians' ability to safely and conveniently cross streets.
Maintenance:	
37. (MED)	Traffic Engineering and City Engineering shall experiment with crosswalk marking materials to try to decrease the frequency that crosswalks need to be remarked.

Spatial Interactions Between Pedestrians and Motorists: Special Surface Treatments

Special Surface Treatment Installation Criteria

A contrasting pavement surface in the crosswalk area is an alternative method to painted pavement of delineating and drawing attention to a pedestrian crossing. Examples include brick pavers and textured concrete. However, brick pavers do not stand up well to winter plowing. Also, if the roadway is asphalt and a textured concrete crosswalk is installed, over time a raised lip will form where the asphalt and concrete meet. As a result, the benefits of using these techniques in our climate is unclear and should be investigated further before being applied extensively.

The raised crosswalk is another technique for increasing the visibility of a crosswalk. Because the street is raised to the level of the sidewalk rather than lowering the sidewalk to the level of the street, raised crosswalks send the message that this is an important pedestrian area and that motor vehicles are guests and need to yield to pedestrians. Of course, motorists are obliged to yield to pedestrians whether or not the crosswalk is raised, but raising the crosswalk emphasizes this point and makes motorist yielding more likely since they typically slow down as they approach a raised crossing. The slope on the side of the raised crosswalk can be painted with ladder markings to increase its visibility. If a crosswalk is raised, a warning detectable to visually impaired pedestrians should be incorporated into the design to alert these pedestrians that they are entering the street.

Areas that should be considered for special surface treatments for crosswalks include high pedestrian volumes and commercial areas. Special surface treatments can also be used successfully in conjunction with other traffic calming techniques. Currently, special surface techniques are used only infrequently on Madison's streets. The reconstruction of Martin Luther King, Jr. Boulevard will include a demonstration of a raised crosswalk.

Special Surface Treatment Design

There are several design considerations that should be appraised when designing special surface treatments. A primary reason for installing special surface treatments is to enhance a crosswalk's visibility. Three mechanisms for achieving this enhanced visibility are through color, texture and elevation. For all three techniques, enhancing visibility is accomplished through contrast with the surrounding area. If the color or texture is too similar to the surrounding area or the difference in elevation too subtle, motorists are not likely to notice the crossing any more than they would if regular pavement markings had been used.

Slip resistance is another design issue to consider. Some pavers can get slippery when wet. Materials should be selected that minimize this tendency. Another consideration is the traffic that uses the street where the special surface treatment is to be installed. Different materials will hold up to varying degrees depending on the mix of cars, trucks and buses that use the street. The more heavy traffic using the street, the more durable the material needs to be.

There are several special design concerns for raised crosswalks. Because the sidewalk and the crosswalk are at the same level, if an adequate texture warning is not installed before the crosswalk, visually impaired people may not recognize when they enter the street. In addition, raised crosswalks are a challenge for snow plows and buses. If care is not taken to design a smooth transition between the street and the sloped edge of the raised crosswalk, snow plows can catch on these edges. Also, although the gradual slope and flat top of the raised crosswalk provides a gradual transition for cars, raised crosswalks can still be jolting for buses because of their long wheelbase. Therefore, bus routes are typically not candidates for raised crosswalks.

Special Surface Treatment Maintenance

See maintenance issues raised in above discussions about installing and designing special surface treatments.

SPECIAL SURFACE TREATMENT RECOMMENDATIONS

Installation:

38. (MED) Traffic Engineering shall continue to research the pros and cons of special surface treatment options for crosswalks such as pavers, colored or textured concrete, and raised crosswalks to develop recommendations about locations where installing such treatments will improve pedestrian access, convenience and safety.

Design:

39. (LOW) Traffic Engineering and City Engineering shall continue to research special surface treatment design and make recommendations for improving their design.

Maintenance:

40. (LOW) Traffic Engineering and City Engineering shall continue to research special surface treatment maintenance issues and shall make recommendations for improving their maintenance based on their findings.

Spatial Interactions Between Pedestrians and Motorists: Refuge Islands

Refuge Island Installation Criteria

Refuge islands allow pedestrians to cross traffic in each direction of travel separately. Therefore, where refuge islands are provided, pedestrians only have to find an adequate gap in traffic in one direction of travel at a time. This can significantly reduce pedestrian delay and chances of conflict with motorists. Where pedestrians experience less delay, they are more likely to wait for an adequate gap in traffic to cross, and therefore less likely to try to dash across the street in a less than adequate gap.

Refuge islands allow pedestrians to cross traffic in each direction of travel separately.

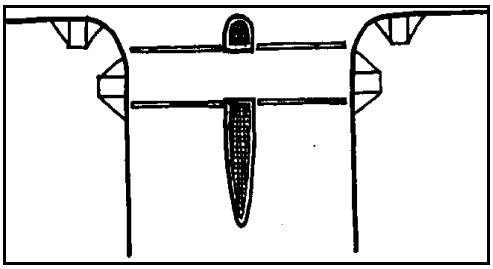
There are two important issues to consider in locating pedestrian refuges: street width and traffic characteristics. Street width is an important consideration from two perspectives. First, wide streets increase pedestrian crossing time. A refuge island means that a pedestrian has a shorter distance to travel at one time and therefore a smaller gap is necessary to make progress crossing the street. Another benefit refuge islands provide is having to cross fewer travel lanes at once, thereby simplifying the crossing. Wider streets tend to have more travel lanes, often including turn lanes, and thus more complicated travel patterns. Traffic characteristics typically relate to street widths, so that streets with higher traffic volumes will tend to be wider and tend to qualify for a refuge island on the basis of street width. Some streets however, such as Monroe Street or Regent Street, are not particularly wide but have a continuous traffic stream with few gaps during rush hour and therefore might benefit from a refuge island.

Most commonly in Madison, refuge islands are incorporated into a median (e.g. intersection of Regent St and Park St) or are the triangular "pork chop" variety located between a free flow turn lane and the through travel lanes (e.g. Regent St and W. Washington Ave). There are also several 'stand alone' refuge islands in Madison, including on High Point Road at Tree Lane and West Washington Avenue at Henry Street. Also, a 'stand alone' refuge island is being installed in Regent Street at Vista Road to facilitate students crossing Regent Street to West High School.

The City of Madison currently uses several criteria for determining if installing a refuge island in any particular location would be beneficial to pedestrian travel. Generally, there should be more than two traffic lanes and adequate gaps in vehicular traffic for pedestrians to cross should be infrequent. In addition, a significant number of pedestrians should want to cross at the location in question. This can be determined by noting nearby destinations where pedestrians are likely to want to go. Another important criterion the City considers is whether or not there is enough space available in the right of way to install a refuge island.

Refuge Island Design Guidelines

Refuge islands need to be accessible. In most cases this is accomplished more conveniently with an at-grade passage through the refuge island, rather than with ramps up and down. If up and down ramps are provided, the refuge island needs to be at least 15 feet wide to be able to accommodate two five foot ramps plus a five foot landing. Refuge islands can also be designed to have the pedestrian crossing area raised less than six inches so that the distance needed to accommodate the ramps can be shortened. When at-grade passage through the refuge island is provided, it must be at least four feet across to provide space for a wheelchair to wait. To provide enough space for a bicycle, for a wheelchair user to turn around and/or for a person pushing a wheelchair to be protected, the refuge island needs to be at least six feet wide. Also, as refuge islands are widened, more space for shy distance from the moving traffic is provided and therefore a pedestrian's sense of safety increases.



Accessibility, visibility and snow removal are several issues to consider when designing pedestrian refuge islands.
[From Portland Ped Guidelines, p. D-5]

Refuge islands should have landscaping and surface treatments that do not compromise the visibility of pedestrians crossing in the crosswalk. Refuge islands at intersections should have a median "nose" that gives protection to the crossing pedestrian.

Several other issues to consider in refuge island design are pedestrian visibility and snow removal. A raised island with up and down ramps provides better visibility than at-grade passage through the refuge island. On the other hand, refuge islands with an at-grade passage and an at-grade nose or no nose are easier for City equipment to clear in the winter.

Examples of varied refuge island designs are often quite close to each other. Many of the crosswalks across the boulevard on Segoe Road are designed differently and provide pedestrians with varying degrees of protection. At the intersection of Segoe Road and Sheboygan Avenue, for example, the boulevard along Segoe Road has not been incorporated into the crosswalk across Segoe Road to provide pedestrians a protected refuge at the median. The present configuration provides space for pedestrians to wait, but the extent of protection from turning traffic could be improved. On the other hand, the boulevard has been incorporated successfully into the crosswalk across Segoe Road at Sawyer Terrace, providing pedestrians with excellent protection.

Refuge Island Maintenance

Refuge island maintenance should follow the same guidelines as sidewalk and curb ramp maintenance.

REFUGE ISLAND RECOMMENDATIONS

Installation:

41. (CONT) Traffic Engineering shall continue to follow its current guidelines for determining where refuge islands should be installed.

Design:

42. (LOW) Traffic Engineering shall research refuge island design further and make recommendations about how pedestrian refuge islands could be better designed to enhance pedestrian travel.

Maintenance:

See maintenance recommendations for sidewalks and curb ramps.

Spatial Interactions Between Pedestrians and Motorists: Grade Separated Crossings

Grade Separated Crossing Installation Criteria

Grade-separated crossings can provide pedestrians access across facilities such as limited access highways that would otherwise be barriers to pedestrian travel.

A grade-separated rather than an at-grade crossing is most likely to be successful when traffic conditions are such that pedestrians perceive that the added effort required to use the overpass or underpass is worth it. Generally there should not be any at-grade crossing opportunities near by. Also, vehicular traffic volumes should be high enough and/or traffic speeds fast enough that adequate gaps for pedestrians to cross the street at-grade safely are infrequent. Grade separated crossings are particularly useful for providing pedestrian access across limited access highways. Several pedestrian overpasses as well as several pedestrian underpasses have been installed across the West and South Beltlines to maintain safe and convenient pedestrian access and mobility across this limited access highway.

Another particularly successful setting for grade separated crossings is where the two sides of the street to be crossed are at different elevations. The pedestrian overpass over Campus Drive is particularly successful because it not only provides pedestrians with convenient access across Campus Drive, but it also provides them with a convenient way to traverse the elevation difference between the two sides of the street.

Other candidate locations for grade separated crossings include areas where there are pedestrian 'attractors' such as schools, shopping centers, recreational areas, parking garages or other types of activity centers that are separated from residential 'generators' by arterial streets. The underpass across the South Beltline at Struck Street serves this function by connecting the people who live to the south of the Beltline to the commercial areas and the schools to the north of the highway.

There are a number of both underpasses and overpasses in Madison. Underpasses are located at Struck St under the Beltline, Spring Harbor Dr under University Ave, Wright St under East Washington Ave, School Rd under Northport Dr, Olin-Turville Court under John Nolen Dr, and Williamsburg Way under Verona Rd. Two overpasses cross over the Beltline, two over Park St and one each over University Ave, Campus Dr, Highway 51, and W. Washington Ave. Another overpass at the Beltline and Hammersley Rd is in the planning stages.

Grade-Separated Crossing Design

Overpasses are more commonly used than underpasses with each having inherent advantages and disadvantages. Overpasses require a greater vertical separation than that required for underpasses due to the need to provide adequate clearance for large trucks. The greater vertical height of overpasses generally requires greater right-of-way to provide acceptable ramp slopes. The standard vertical clearance for an overpass is 17 feet, with an additional three feet allowed for the depth of the structure, for a total rise of 20 feet. At a five percent grade, this requires a 400 foot approach ramp at each end, or a total of 800 feet - a significant additional distance to have to travel. In addition, overpasses, unless enclosed, are open to the weather. On the other hand, because overpasses are typically more open than underpasses they usually present fewer security problems.

The underpass clearance height, usually 8-10 feet, can be less than half that of an overpass resulting in shorter stair flights or ramps and reduced right-of-way requirements. The disadvantages to underpass structures include the expense of relocation of utilities, drainage problems and perceptions of insecurity leading to pedestrian avoidance.

The relative elevations of the highway and pedestrian crossing have a significant effect on grade separation cost and potential use. Crossing structure costs and right-of-way requirements are substantially less at locations where the highway is depressed or elevated relative to the pedestrian crossing. Use of the structure will also be greater at this type of location because shorter ramps will be needed. The feasibility of underpasses can be improved where it is possible to slope the roadway up over the underpass. Perceived underpass security can be increased by providing wall and roof openings for 'daylighting', by high artificial lighting levels, by avoiding changes in path direction that may produce hidden areas, by consistent maintenance and cleaning and by providing greater horizontal or vertical clearances.

The walking widths should be designed to accommodate the projected pedestrian and bicycle traffic. If the projected pedestrian density is relatively low, then the walkway width on the

structure approaches and on the structure itself should be a minimum of 8 feet to allow sufficient space for wheelchair passing and turning. Minimum clear widths on approach walkways and ramps should be at least 5 feet to permit pedestrians to pass and to permit wheelchair passing.

Madison's new grade-separated crossings such as the underpass under John Nolen Dr is designed to accommodate wheelchair access (see also the underpass under Verona Rd in Fitchburg). Several of the structures, on the other hand, were designed and constructed before ADA design guidelines were developed. For some of these, stairs provide the only access: Spring Harbor Drive and School Road. And for others the ramp slope is steep and wheelchair access is difficult, such as the overpass over West Washington Avenue.

Grade Separated Crossing Maintenance

Maintenance issues for grade separated crossings are similar to those for sidewalks. Please refer to sidewalk maintenance for further discussion.

GRADE SEPARATED CROSSING RECOMMENDATIONS

Installation:

43. (CONT) Traffic Engineering shall continue to recommend grade-separated crossings in locations where pedestrians are likely to perceive the additional effort required to use the overpass or underpass as beneficial.

Design:

44. (CONT) Traffic Engineering and City Engineering shall continue to consult city and national guidelines for designing grade-separated crossings.

Maintenance:

See recommendations for sidewalk maintenance.

Temporal Interactions Between Pedestrians and Motorists: Pedestrian Signals

Pedestrian Signal Installation Criteria

Pedestrian signals are installed in Madison based on the warrants established in the MUTCD.

"Pedestrian signal indications shall be installed in conjunction with vehicular traffic signals under any of the following conditions:

1. When a traffic signal is installed under the Pedestrian Volume or School Crossing warrant.
2. When an exclusive interval or phase is provided or made available for pedestrian movements in one or more directions, with all conflicting vehicular movements being stopped.
3. When vehicular indications are not visible to pedestrians such as on one-way streets, at 'T' intersections, or when the vehicular indications are in a position which would not adequately serve pedestrians.
4. At established school crossings at intersections signalized under any warrant."

"Pedestrian signal indications also may be installed under any of the following conditions:

1. When any volume of pedestrian activity requires use of a pedestrian clearance interval to minimize vehicular-pedestrian conflicts or when it is necessary to assist pedestrians in making a safe crossing.
2. When multi-phase indications would tend to confuse pedestrians guided only by vehicle signal indications.
3. When pedestrians cross part of the street, to or from an island, during a particular interval where they should not be permitted to cross another part of that street during any part of the same interval."

In observing pedestrian signal operations and pedestrian behavior in Madison, some pedestrian signals appear to be more useful and better observed than others. Pedestrian signals can be useful when the pedestrian phase lengthens the overall cycle length to provide enough time for pedestrians to cross. Typically any actuated signal, and therefore any signal where there is a pedestrian button, meets this criterion. Although the additional time that is provided when this cycle is actuated facilitates pedestrian travel, many pedestrians do not understand that pushing the pedestrian button changes the overall signal cycle. Also, some advocates argue that pedestrians should not be required to press a button in order to legally cross the street. Rather, they argue time should be built into all cycle lengths to provide pedestrians enough time to cross the street and that there should be no need to provide pedestrian signals to serve this function.

Legally, pedestrian signals hinder pedestrian travel when adequate gaps for crossing present themselves during the solid DON'T WALK. Also, pedestrians may arrive at an actuated

crossing just after the traffic signal in their direction of travel has turned green. To cross the street legally, the pedestrian is required to press the push button and wait for the next cycle. Most often pedestrians consider this delay inconvenient and will proceed across the street in spite of the solid DON'T WALK. One possible solution to this problem would be to not make crossing against a DON'T WALK illegal, but rather to change the pedestrian's responsibilities to indicate that during a WALK phase motorists are expected to yield to pedestrians, but that during the solid DON'T WALK phase pedestrians are expected to yield to motorists. If this were done, YIELD TO VEHICLES might be more appropriate wording than DON'T WALK. Another possible solution is to remove or not install a pedestrian signal.

Pedestrian Signal Design Guidelines

One commonly voiced complaint about pedestrian signals is that they do not give pedestrians enough time to cross. In some cases, pedestrians perceive this to be the case because they do not understand the operation of the pedestrian signals. In other cases, pedestrians, especially those with special needs, truly may require more time to cross the street than is available.

The operation of pedestrian signals includes three phases: WALK, flashing DON'T WALK, and steady DON'T WALK. Pedestrians are legally allowed to enter the crosswalk during the WALK phase. The flashing DON'T WALK is where the confusion about pedestrian signal timing typically arises. The flashing DON'T WALK is designed as a "clearance interval." If a pedestrian has already entered the crosswalk, the flashing DON'T WALK should provide enough time for the pedestrian to reach the other side or to a refuge island before the opposing vehicle traffic proceeds on a green. If a pedestrian has not yet entered the crosswalk when it begins to flash DON'T WALK, s/he is not allowed to begin to cross until the next cycle. During the steady DON'T WALK phase, pedestrians are not allowed to enter the crosswalk.

Educational signs explaining the operation of pedestrian signals have been installed at some intersections, particularly in the downtown area (Traffic Engineering has published a brochure describing pedestrian signal operation).

PEDESTRIAN SIGNAL RECOMMENDATIONS

Installation:

45. (CONT) Traffic Engineering shall continue to follow MUTCD guidelines for determining where to install pedestrian signals.

Design:

46. (CONT) Traffic Engineering shall continue to install and maintain educational signs and stickers explaining pedestrian signal operation at both fixed time and actuated traffic control signals with pedestrian signals.

Temporal Interactions Between Pedestrians and Motorists: Traffic Signal Timing

Traffic Signal Timing Design Guidelines

Traffic signals are one way that both motorists and pedestrians can be given direction about when each should proceed through the intersection. Typically in Madison, the minimum length for the WALK interval on a pedestrian signal indication is 7 seconds, just long enough for a pedestrian to step off the curb and begin crossing. The length of the flashing DON'T WALK interval and subsequent delay in giving opposing traffic a green light should be calculated based on crossing the street with an assumed pedestrian crossing speed of four feet/second (or slower if there are many elderly or disabled people who cross at the intersection).

Generally, the WALK interval is made as long as possible given the length of the green signal phase for traffic in the same direction; that is, the WALK interval is equal to the length of the green interval minus the pedestrian clearance interval. Where the green phase for the traffic signal would otherwise be shorter, the minimum time required to operate the WALK interval and clearance interval may control the length of the phase. At these locations, typically, pedestrian push buttons and signals are installed.

Conflicts between pedestrians and turning motorists are a special concern at intersections. Traffic signal timing can be employed to at least partially control these interactions. For example, if there is a dedicated turning arrow phase for the motor vehicle traffic, the pedestrian signal for the crosswalk across which the traffic will turn is not actuated at the same time as the turning phase.

Other turning movements are not as closely controlled by traffic control signals. Permissive turns (when motorists turn either right or left on a solid green signal) are of particular concern for potential conflicts between pedestrians and motorists. In some situations in Madison, pedestrians are given an 'advance' WALK to allow them to get a good start crossing the street before the motorists get a green signal. The logic behind the 'advance' WALK is that if the pedestrians are well into the intersection before the motorists proceed, motorists will be more likely to see them and to yield to them in the crosswalk. The intersection of Monroe Street and Grant Street is one location where pedestrians have an 'advance' WALK signal.

In other cases, such as at a 'T' intersection or turn-only lane, the vehicular traffic may have an ordinary green signal, and both the green signal and the WALK signal are actuated simultaneously. Motorists are expected to yield to pedestrians in the crosswalk in this situation, but do not always recognize their duty.

TRAFFIC SIGNAL TIMING RECOMMENDATIONS

47. (MED) Traffic Engineering shall work proactively with pedestrian advocates to review pedestrian concerns about pedestrian signals and make recommendations for improving pedestrian safety and convenience through adjustments to pedestrian signal timing and push button installation guidelines.

Temporal Interactions Between Pedestrians and Motorists: Pedestrian Detector Mechanisms

Pedestrian Detection Design

Fixed Time Signals

Fixed time signals have a regular cycle of phases with a fixed amount of green time for each movement. There is a regular WALK phase in each direction for each cycle. Fixed time signals are provided where traffic conditions are predictable enough that varying the signal timing is not necessary to accommodate changing traffic conditions at the intersection. They are common in the downtown and campus area where pedestrians are generally waiting to cross the street at each signal cycle for most daylight hours.

Actuated Signals

Actuated signals rely on detecting vehicles and/or pedestrians to actuate all signal cycles. Because these signals actuate based on pedestrian and vehicular traffic at the intersection, these signals are responsive to varying traffic conditions.

At actuated signals, pedestrians will not get a WALK light unless they are detected. Typically, pedestrian detection is accomplished when a pedestrian presses a pedestrian push button. Some cities are experimenting with video detection, but this is expensive. Also, loop detectors, such as those used to detect bicycles and cars, can be used to detect wheelchair users. This type of detection might be useful on known wheelchair user routes. However, because they are expensive and because loops cannot detect all pedestrians, their usefulness as a detector mechanism is limited.

Pedestrian Push Buttons

Pedestrian push buttons are the most common method of detecting pedestrians. Typically, pressing the button will mean that the next time the parallel vehicular traffic signal cycles to green, the WALK and clearance interval phases will be included in the cycle. Push buttons are installed in several types of situations:

- Traffic volumes on the side street are considerably lower than the main street.
- The pedestrian signal is long (on a wide street, for example) and eliminating it when there is no pedestrian demand significantly improves the level of service to motorists on the main street and to pedestrians crossing in the other direction.

Accessibility of pedestrian push buttons is an important design consideration. Typically in Madison, pedestrian push buttons are mounted on the traffic signal or street light pole closest to the crosswalk. This is convenient for installation, but is not necessarily convenient for pedestrians using the push button. In the winter, snow is sometimes piled in front of the push button. Even when there is no snow on the ground, many pedestrian push buttons are not accessible for some pedestrians, especially wheelchair users. There is sometimes three feet or more between the edge of the sidewalk and the pedestrian push button. If this area is not level and/or is muddy wheelchair users have a difficult or impossible time accessing these push buttons. Many pedestrian push buttons on medians are also inaccessible to wheelchair users because either the median is not mountable or, like at the side of the street, the button is too far away from the edge of the paved area for the pedestrian to reach.

Several design solutions to improve pedestrian push button accessibility are possible. In many locations, simply retrofitting a concrete pad between the current sidewalk edge and the pedestrian push button provides an easy and economical solution. In other situations, placing the pedestrian push button on either an extender arm or its own pole can improve its accessibility.

PEDESTRIAN DETECTOR MECHANISM RECOMMENDATIONS

48. (MED) Traffic Engineering shall continue to research pedestrian push button placement and to make recommendations about modifying guidelines for pedestrian push button and other detection systems that will improve pedestrian accessibility.

Special Pedestrian Crossing Situations: Mid-Block Crossings

Mid-Block Crossing Installation Criteria

Pedestrians can legally cross the street mid-block except between consecutive intersections that are both signalized. Unlike at crosswalks at street corners, pedestrian rights and responsibilities change for mid-block crossings depending on whether or not there is a marked crosswalk. At a street corner, there is a legal crosswalk whether or not it is marked (assuming there are sidewalks leading to the intersection) and therefore motorists are required to yield to pedestrians whether or not the crosswalk is marked. When pedestrians cross the street mid-block, on the other hand, motorists are required to yield to pedestrians only when a pedestrian is crossing within a marked mid-block crossing. If pedestrians cross the street mid-block outside of a marked crosswalk, there is no legal crosswalk defined and pedestrians must yield the right of way to motorists.

Mid-block crosswalks enhance pedestrian travel in two situations in particular, so it is in these locations where the City of Madison installs mid-block crosswalks. First, they are useful where many pedestrians come from one side of the street and want to access a popular

destination on the opposite side of the street. For example, there is a mid-block crosswalk on Langdon Street to directly connect the Memorial Union with Library Mall. Mid-block crosswalks have also been installed in front of several elementary schools where the school is on a busy street and many of the students live in the neighborhood across this street. Such crosswalks can be found, for example, at Crestwood Elementary School on Old Sauk Road and Midvale Elementary School on Midvale Boulevard. Second, mid-block crosswalks enhance pedestrian travel where pedestrian connectors cross streets. Marking these locations serves two purposes: alert motorists to watch out for pedestrians and shift the yielding the right of way responsibilities from the pedestrian to the motorist. Where the Isthmus bike path crosses local streets mid-block, ladder (zebra) crosswalks have been installed.

Mid-Block Crossing Design

See Crosswalk Marking Design section.

MID-BLOCK CROSSWALK RECOMMENDATIONS

Installation:

49. (CONT)	Traffic Engineering shall continue to consult its current guidelines for making decisions about where to install mid-block crosswalks.

Special Pedestrian Crossing Situations: 'T' Intersections

T Intersection Design

For crosswalks at 'T' intersections, one end is at a conventional corner, while the other ends at a straight section of sidewalk. When the crosswalk is not marked on the pavement, the non-corner end of the crosswalk may be difficult to distinguish from a mid-block location. At 'T' intersections, as at all crosswalks, a curb ramp should be located at each end of each legal crosswalk. In Madison, curb ramps are sometimes at these locations, but many times there is either no curb ramp or there is a driveway.

T INTERSECTION RECOMMENDATIONS

Design:

50. (HIGH) City Engineering shall require contractors and developers to install curb ramps at each end of crosswalks at T intersections.

Special Pedestrian Crossing Situations: Free Flow Turn Lanes

Free Flow Turn Lane Design

There are several factors that affect how well free flow turn lanes function for pedestrians. One factor is whether the turning traffic must yield to the cross street traffic or has a dedicated lane to turn into. A free flow turn lane designed so that turning traffic must yield to the cross street traffic gives pedestrians an advantage. In this situation, if the traffic volume on the cross street is low it is also likely that the turning traffic volume will be low, so there will be gaps for pedestrians to cross. However, motorist attention may be directed at other motorists and not at pedestrians wanting to cross.

Where turning traffic moves into a dedicated lane and does not yield to cross traffic, motorist speeds in the free flow turn lane are likely to be higher, motorists are more likely to fail to yield to pedestrians in crosswalks, and there may be inadequate gaps for pedestrian crossing.

Another consideration in determining the likely impact of a free flow turn lane on pedestrian travel is the speed limit on the street onto which the motorist is turning. When the street onto which the motorist is turning has a higher speed limit, the motorist will likely be accelerating to the speed limit of the street onto which s/he is turning. As a result, some pedestrians consider the free flow turn lane at Verona Road and the Beltline as more difficult to cross than the one at Regent Street and West Washington Ave.

Over the years, the City has received many requests to install traffic control signals at free flow turn lanes. Experiments with traffic control signals have had limited success, especially when pedestrian crossings are infrequent. There used to be a pedestrian actuated signal on the

southeast corner of Park Street and West Washington Ave. Often times pedestrians would push the pedestrian push button to call the WALK signal, but there would be an adequate gap in traffic to cross before the signal changed. The pedestrian would go ahead and cross and when the signal would change to stop traffic, the pedestrian would already have crossed. For this reason, the signal was eventually removed. There is still a traffic control signal on the northwest corner of Park Street and Fish Hatchery Road. The problem experienced with this signal is that so few pedestrians push the pedestrian push button so infrequently that the signal for the vehicles is almost always green. It is so infrequent that the signal is red that many motorists do not even notice it is there. Therefore, the City's experience with traffic control signals at free flow right turn lanes has shown they are not effective either from the pedestrian's or the motorist's perspective.

FREE FLOW TURN LANE RECOMMENDATIONS

Design:

51. (LOW) Traffic Engineering shall not recommend free flow turn lanes in areas of high pedestrian activity, or where such lanes would compromise pedestrian access, mobility and/or safety.

Street Design

Street design impacts pedestrian travel in several ways. Perhaps the most obvious impact is how street design influences a pedestrian's ability to easily cross the street, including how far a pedestrian has to cross in a single stretch as well as traffic characteristics such as its volume and speed. These variables each influence the pedestrian's exposure to conflict and the frequency of adequate gaps to cross the street. Street design also influences the general atmosphere for walking in the corridor. In general wider streets, with more and faster traffic are not as pleasant for walking as narrower streets with less and slower traffic.

Street width impacts both vehicular and pedestrian travel. Typically, street widths are selected after considering such issues as the types of vehicles, volume of traffic and speed of traffic that will be expected on the street.Often little consideration is given to the impacts on pedestrian travel.

Pedestrians are impacted by street widths in two primary ways: crossing the street and the pedestrian environment. Total pedestrian crossing distance corresponds to a pedestrian's exposure to potential conflict with vehicles. The wider the street, the greater the total crossing distance, the more time it takes a pedestrian to cross the street and therefore the greater the exposure to possible conflict with vehicles.

Street width also impacts the nature of the environment in which pedestrians walk. The wider the street, typically the larger the spaces around the pedestrian. In addition, where steets are

wider, there is usually more traffic.

STREET WIDTH RECOMMENDATIONS

52. (HIGH) The Public Works, Transportation, and Planning and Development Departments and Madison Metro shall consider implications for pedestrian travel when they select street widths, corner radii, bus routes and bus stop locations.

Traffic Calming Measures

Neighborhood traffic management goes hand in hand with making Madison an even better place to walk. This section discusses some traffic calming measures that can be used to manage neighborhood traffic. These measures can be implemented for a number of reasons, including as a design feature, as a measure to try to slow vehicular traffic speeds, or as a mechanism to enhance pedestrian travel. Traffic calming measures have the potential to impact pedestrian travel in several ways: slow vehicular traffic, shorten pedestrian crossing distances, draw attention to a pedestrian crossing, or enhance the visual environment.

Neckdown Installation and Design

A neckdown is a narrowing of a street, either at an intersection or midblock, in order to reduce the width of the street. While the term usually is applied to a design which widens a sidewalk at the point of crossing, it also includes the use of islands that force traffic toward the curb while reducing the roadway width. The discussion of neckdowns in the earlier street crossing section focuses on the former of these applications.

Motorists tend to drive at speed they consider safe and reasonable and tend to drive more slowly on narrower roads and traffic lanes than on wider ones. Reducing road widths by widening boulevards or sidewalks intermittently or introducing medians, can reduce traffic speeds. The judicious placement of parking can achieve the same effect.

The Institute of Transportation Engineers (ITE) states in its manual, *Residential Street Design and Traffic Control*, "streets narrowed at the crosswalk reduce the distance over which pedestrians are exposed to vehicular traffic. Bulbs provide safe areas for people to walk or play, or may provide added area for landscape or gateway features, thereby improving the appearance of the neighborhood.

"*Effects on Traffic Volume:* Studies to date have shown that neckdowns reduce traffic volume only when they either reduce the number of lanes of travel or add friction to a considerable length of street.

"*Effects on Speed:* Neckdowns appear to have significant effect on speed.

"*Effects on Noise, Air Quality and Energy Conservation:* No significant effects have been identified.

"*Effects on Traffic Safety:* Neckdowns can improve the safety of an intersection by providing pedestrians and drivers with an improved view of one another. They also reduce pedestrian crossing distance, thereby lowering their exposure time to vehicles.

"*Uniform Standards:* Neckdowns can be considered to be either normal extensions of the existing curb or channelizing islands as defined in the MUTCD."

Several criteria should be considered in determining whether or not to install a neckdown:

Bicycle Accommodations: On local streets designated as a bicycle route or servicing a significant volume of bicycle traffic, a sufficiently wide bicycle lane or wide curb lane should be provided through the narrowed areas to maintain adequate bicycle access and mobility.

Snow Removal: The pavement width of streets should not be narrowed to a point where snow removal is impeded.

Parking Restrictions: In most cases on local access streets, street narrowing will require the prohibition of parking at all times along the street curb the full length of the narrowed section plus 20 feet.

Landscaping: Median landscaping can be selected by the local neighborhood association from an approved landscaping materials list provided by the City. Landscaping will be provided and installed by the City and will be maintained by the neighborhood association or landscape volunteer. If the landscaping is not maintained, the median will be topped with an asphalt pavement.

Median Width/Lane Width: Where medians are used to narrow streets, the medians shall not be constructed which are less than six feet in width. Travel lanes shall not be narrowed to a width less than nine feet, exclusive of gutter. Bicycle lanes where required shall be four feet wide exclusive of gutter, unless gutter is poured integral to the bicycle lane in which case the bicycle lane should be five feet wide. If parking is allowed, the parking and bicycle lane combination shall be a minimum of 13 feet.

There are several special concerns for visually impaired pedestrians. Hauger et al. report that visually impaired pedestrians are more likely to be confused by and to make unsuccessful street crossings at projected intersections (neckdowns) than at conventional intersections. Most visually impaired pedestrians can learn to cross familiar intersections having neckdowns with minimal difficulty, however problems stem from difficulties recognizing the presence of this still unusual design, and knowing and using some special strategies for maintaining orientation and for finding crosswalks in this situation. The scale of the intersection having neckdowns, as well as the rest of its geometry and landscaping can all contribute to making crosswalks hard to find, and to increasing the likelihood that visually impaired pedestrians will

cross outside of crosswalks.

Traffic Circle Installation and Design

Traffic circles are circles of varying diameter formed by curbs placed in intersections functionally classified as local streets. Motorists must drive around the circle, or more infrequently in the case of longer vehicles, the driver may drive slowly onto and over a mountable concrete curb forming the circle. Traffic circles reduce motor vehicle speeds through the intersection, depending on the current intersection controls in place.

ITE states in its manual, *Residential Street Design and Traffic Control*, outlines several ways traffic circles impact traffic:

Effect on Traffic Speed: The effect on vehicle speed has been shown to be related to the size of the circle, the distance from the circle at which speeds are measured, and the presence or absence of additional obstructions at the intersections. Overall, the effect of circles on speeds is varied: some only slow down the fastest, most objectionable vehicles and only in their immediate vicinity; others cause substantial drops in the speeds of all vehicles at the intersection.

Effect on Noise, Air Quality, and Energy Consumption: Effects in these areas are marginal as they relate to small effective changes in speed and volume.

Several design criteria should be considered in designing traffic circles:

Circle Size: For each intersection, the size of the circle will vary depending on the circumstances for that specific intersection. In general, the size of the circle will be determined by the geometrics of the intersection with the largest circle that meets the design consideration shown below. Note that in most instances the circle constructed will be smaller to accommodate snow removal equipment.

Different Width Streets: Where intersecting streets differ significantly in width, it may be more appropriate to design an elongated 'circle' using half circles with tangent sections between them. Smaller circles will be considered on a case by case basis. Normally, the circle will be located as close to the middle of the intersection as practical. Under special circumstances, such as being on a Fire Department response route, bus route or due to snow removal accommodations, the size and/or location of the circle may be adjusted to meet these special circumstances.

Signage: Normally one object marker sign should be installed facing each vehicle approach.

Channelization: Where curbs do not exist on the street corners, painted barrier lines defining the corners should be installed. Yellow retro-reflective lane line markers shall be placed on top of the circle at its outer edge. Silver retro-reflective lane line markers shall be placed on the top of the curb for any curb extensions.

Parking Removal: Normally, parking will not be prohibited in the vicinity of the circle beyond that which is prohibited by the City, i.e. 'within the intersection,' or 'within 20 feet of a crosswalk' (12.125(6)). However, where special circumstances dictate, additional parking may be prohibited as needed. Circumstances that may require additional parking restrictions include where the circle is on a response route for the Fire Department, where there are special snow removal needs, or where there is an unusually high use by trucks.

Sign Removal: At intersections where traffic circles are installed, previous right-of-way control signs such as stop and yield signs may be removed when the circle is completed. However, where special circumstances dictate, the existing traffic control may remain in place or be otherwise modified at the direction of the City Traffic Engineer.

Landscaping: Traffic circle landscaping can be selected by the local neighborhood association from an approved landscaping materials list provided by the City. Landscaping will be provided and installed by the City and will be maintained by the neighborhood association or landscape volunteer. If the landscaping is not maintained, the median will be topped with an asphalt pavement.

Chicane Installation and Design

Chicanes are a form of curb extension that alternate from one side of the street to the other. The road is in effect narrowed first from one side and then the other and then from the first side again in relatively short succession. Chicanes break up the typically long sight lines along streets and thus combine physical and psychological techniques to reduce speeds.

Several design criteria should be considered in designing chicanes:

Lane Width: Where chicanes are used, the travel lanes shall not be narrowed to a width less than nine feet exclusive of the gutter. Bicycle lanes, where provided, shall be four feet wide exclusive of gutter, unless the gutter is poured integral to the bicycle lane, in which case the bicycle lane should be five feet.

Snow Removal: Chicanes shall be designed to minimize the accumulation of snow piles and trash in the gutter interface between existing curb and gutter and the chicane.

Landscaping: Chicane landscaping can be selected by the local neighborhood association from an approved landscaping materials list provided by the City. Landscaping will be provided and installed by the City and will be maintained by the neighborhood association or landscape volunteer. If the landscaping is not maintained, the median will be topped with an asphalt pavement.

Speed Hump Installation and Design

Raised street sections, or speed humps, can reduce vehicle speeds on local streets. The hump

is a raised area, no greater than 3.5 inches high, extending traversely across the street. Speed humps typically are constructed with a longitudinal length of 12 feet.

Several design criteria should be considered in designing speed humps:

Signing and Marking: Speed humps must be signed and marked to warn motorists and bicyclists of their presence.

Traffic Safety and Diversion: Speed humps must consider the impact on long wheel-based vehicles (fire trucks, ambulances, snow plows, garbage trucks) and the potential to divert traffic to other adjacent streets.

Street Functional Classification: Speed humps shall only be installed on streets classified as local and should only be installed to address documented safety problems or traffic concerns supported by traffic engineering studies.

Street Width: Speed humps shall be installed only on streets with no more than two travel lanes and less than or equal to 32 feet in width. In addition, the pavement surface should be in good condition and should drain well.

Street Grade and Alignment: Speed humps should only be installed on streets with grades of eight percent or less approaching the hump. Speed humps should not be placed within severe horizontal (less than 300 feet) or vertical (less than a minimum safe sight distance) curves. Use AASHTO's *Policy on Geometric Design of Streets* to determine the minimum safe sight distance.

Traffic Speeds: Speed humps should generally be installed only on streets where the posted speed limit is 25 mph or less. Speed humps should be carefully considered on streets where the 85th percentile speed is in excess of 40 mph.

Traffic Volumes: Speed humps should typically be installed only on streets with 3,000 vehicles per day or less. If considered for streets with higher volume, their use should receive special evaluation and justification.

Emergency Vehicle Access: Speed humps should not be installed on streets that are defined or used as primary or routine emergency vehicle access routes.

Transit Routes: Speed humps should not be used along streets with established transit routes.

There are some special considerations for visually impaired pedestrians. Where the street is raised to curb level at an intersection it may be impossible for visually impaired pedestrians to know when they have reached the street. Visually impaired pedestrians who don't realize they've arrived at streets are likely to walk out into intersections without attending to the vehicular sounds they need for determining safe crossing times and appropriate headings. This happens despite the presence of traffic on the street they have inadvertently stepped into. (Bentzen, B.L. & Barlow, J.M. (1995). "Impact of curb ramps on the safety of persons who are blind." *Journal of Visual Impairment and Blindness* 89, 319-328; Hauger, J.S, Rigby, J.C., Safewright, M, & McAuley, W.J. (1996). "Detectable warning surfaces at curb ramps."

Journal of Visual Impairment and Blindness 90, 512-525.)

Hauger et al. also report the recommendation emerging from a meeting of researchers, civil engineers, orientation and mobility specialists (who teach independent travel skills to visually impaired pedestrians), and visually impaired travelers, sponsored by the Access Board in June 1995, that wherever curbs are absent, a two-foot-wide strip of detectable warning be placed at the curb line. The same article reports that a majority (of 30) persons with physical disabilities, using a variety of aids, found curb ramps having detectable warnings to be safer, more stable and to have superior traction as compared with comparable curb ramps having a brushed concrete surface. Forty-four percent also said they required less effort. It should be noted that the curb ramps used in this research had six feet of detectable warning, considerably more than the 24 inches recommended at the Access Board-sponsored meeting in June 1995, but consistent with the suspended requirement of ADAAG 4.7.7. The Access Board-sponsored meeting also recommended the use of detectable warning surfaces which had domes aligned in the direction of travel (unlike those in the research reported by Hauger et al.) as they had been found somewhat easier for persons with physical disabilities to negotiate (Bentzen, B.L., Nolin, T.L., Easton, R.D., Desmarais, L. & Mitchell, P.A. (1994). *Detectable warnings: Safety and negotiability on slopes for persons who are physically impaired*. Washington, DC: Federal Transit Administration and Project ACTION, National Easter Seal Society.)

TRAFFIC CALMING RECOMMENDATIONS

Installation and Design:

53. (HIGH)	Traffic Engineering shall implement its Neighborhood Traffic Management Program as a component of enhancing pedestrian travel in neighborhoods by working toward such goals as slowing vehicular traffic, shortening pedestrian crossing distances, drawing attention to pedestrian crossings, and enhancing the visual environment.
54. (HIGH)	Traffic Engineering shall implement and evaluate traffic calming devices as mechanisms to enhance pedestrian travel.

Transit Connections

Transit users are typically pedestrians when they are getting to the bus stop as well as from the bus to their final destination. If transit users cannot easily walk to and from bus stops, success of the transit system will be limited. A successful transit system enhances the pedestrian transportation system. As trip lengths get longer, fewer people consider walking to be a realistic travel option. Easy access to transit effectively extends the pedestrian's potential range. Several variables influence the quality of the connections between the pedestrian transportation system and the transit system: sidewalks, bus pads and bus stop

amenities such as shelters and benches.

Sidewalks to Bus Stops

Sidewalks should ideally lead directly to all bus stops for all the same reasons that sidewalks should provide access to other common pedestrian destinations. Bus stops that not only have no sidewalk leading to them but also have significant topography and/or vegetation nearby are particularly inaccessible. For example, pedestrians waiting for the bus at the bus stop on Bluff St. near Ridge essentially have to wait in the street because of the lack of sidewalks and the dense vegetation extending directly to the street's edge.

Bus Pads

Bus pads connect the sidewalk to the curb edge to provide pedestrians access for getting on and off the bus. Ideally bus pads are provided at both the front and back door of the bus, but at minimum they should be provided at the front door. To be useful in all seasons, bus pads should be constructed out of concrete and should be cleared of ice and snow in the winter. A grassy terrace might be passable surface some of the time, but during the spring thaw or when its raining this surface can become muddy and impassable.

Bus Stop Amenities

Bus stop amenities influence how easy and pleasant it is to use the transit system. Shelters provide a place for people to wait for the bus protected from the elements. Benches are another amenity that make waiting for the bus more pleasant.

TRANSIT CONNECTIONS RECOMMENDATIONS

55. (MED)	Madison Metro shall work with Traffic Engineering and City Engineering to determine where sidewalks are missing along bus routes and to develop priorities for retrofitting sidewalks in these areas to improve pedestrian access to the transit system.
56. (MED)	Madison Metro shall work with Traffic Engineering and City Engineering to develop strategies for improving how bus pads are provided to create an accessible link between the pedestrian transportation network and the transit system.

Other Pedestrian Facility Planning Considerations

Design, Construction and Maintenance Guidelines for Pedestrian Facilities

A successful transportation system is at least in part defined by consistent treatments of similar situations so that both pedestrians and motorists know what to expect. There are

limited guidelines that have been developed and adopted at national, state and local levels to facilitate implementation of such consistent treatments.

Only a few standards have been defined at a national level. Sections of the Transportation Research Board's (TRB) *Highway Capacity Manual*, the American Association of State Highway and Transportation Official's (AASHTO) *Policy on Geometric Design of Highways and Streets*, and the Federal Highway Administration's (FHWA) *Manual on Uniform Traffic Control Devices* each make some recommendations about pedestrian facility design. These guidelines provide a starting point, but they leave many questions unanswered. For example, no clear guidance is provided for such issues as how to prioritize retrofitting sidewalks in already developed areas, how to handle sidewalk obstructions, where to place sidewalks within the street right-of-way, or criteria for recommending locations for such pedestrian facilities as connector paths or refuge islands. Therefore, these standards provide limited guidance for planning and designing a network of pedestrian facilities, dealing with spot problems, or consistently designing, constructing and maintaining a pedestrian transportation system that strives to provide accessible, convenient, safe and enjoyable pedestrian travel.

Locally, the Madison General Ordinances define guidelines for some aspects of pedestrian facility design and maintenance: 10.06 (sidewalk width), 10.07 (sidewalk grade), 10.23 (sidewalk obstructions including snow), 10.28 (snow and ice removal), and 16.23 (provision of sidewalks). In addition, the City's *Standard Specifications for Public Works Construction* includes a Standard Engineering Plate showing specifications for curb ramp design and describes construction guidelines for sidewalk installation.

Decisions about pedestrian facility provision and design are sometimes made on a project by project basis because some issues are not addressed in the existing guidelines and because not all conditions can be anticipated. Others, although addressed, are scattered in many different locations. It would be useful to have a single comprehensive source of pedestrian facilities design, construction and maintenance guidelines for all City agencies involved in the design, construction and maintenance of pedestrian facilities to be able to refer to guide their decisions.

DESIGN GUIDELINES RECOMMENDATIONS

57. (HIGH)	City agencies and commissions shall refer to the vision, goals, and objectives described in the *Pedestrian Transportation Plan* to guide their decisions about the design, construction and maintenance of pedestrian facilities.
58. (MED)	The Traffic Engineering Division shall work with City agencies involved in the design, construction and maintenance of pedestrian facilities to develop a reference manual of design, construction and maintenance guidelines for pedestrian facilities.

Hazardous Pedestrian Locations

The Traffic Engineering Division reviews all police crash reports and maintains annual pin maps, including separate bicycle and pedestrian pin maps. The Traffic Engineering Division publishes an annual *Crash Report* based on a review of these reports and maps.

In 1996, the Traffic Engineering Division conducted a special study to examine pedestrian crash data for the five year period from 1991 to 1995 in more detail. The number of pedestrian crashes in Madison in any particular year is fairly low (averages 111 per year during this five year period). Therefore, examining multiple years together increases the likelihood that the data sample is representative in indicating problem crash types and locations.

There are a number of valuable reasons for analyzing pedestrian crashes. First, if design-related causes of crashes are identified, designs can be adjusted to minimize these crash types. For this analysis, care should be taken to group locations with similar designs together for the analysis so that the focus is on a particular type of design rather than on a particular location. Education is another reason for analyzing pedestrian crashes. Identifying the main behavioral causes of crashes allows development of education programs to target these concerns. In addition, identifying behavioral causes of crashes makes it possible to target enforcement programs to facilitate behavioral change.

What data are collected and how they are interpreted are important considerations for evaluating pedestrian crash analyses. It is one thing to know that a crash has happened and that it was a particular crash type. To really make sense out of pedestrian crash data, it is important not just to know the crash category, but also the broader context of the crash. Ian Roberts'[1] account of a child pedestrian fatality demonstrates the importance of understanding this context. The child was hit while running across a street at a midblock location. The traffic speed and volume at the crash location were measured one week to the hour after the child was killed. Although the driver claimed she was traveling about 40 kph, the survey showed that the mean speed was 58 kph and the odds a driver was traveling at 40 kph was 0.8 percent. Traffic volume was 877 per hour, or 15 vehicles every minute.

A typical analysis would classify this crash as a dart out and the usual safety solution would suggest enhanced child pedestrian safety programs. However, understanding the broader context of this crash suggests another possible analysis. With traffic volumes and speed as high as those recorded, running across the street might be the only chance, as risky as it is, a pedestrian has to get across the street. Therefore, this broader analysis suggests the pedestrian environment (volume of traffic) and driver behavior (speeding) need to be addressed as well as pedestrian behavior in order to reduce this crash type. Knowledge of the broader context within which the crash occurred can also help to identify design changes to provide a high profile place for pedestrians to cross, or to create breaks in traffic to allow time to cross.

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[1]Roberts, Ian and Carolyn Coggan. "Blaming Children for Child Pedestrian Injuries" *Social Science and Medicine*, 1994, Vol. 38, No. 5, p 749-53.

The data available about a crash clearly influences the type of analysis that is possible and the conclusions that are likely to be drawn. As demonstrated in the above scenario, had the additional traffic information not been gathered, it is unlikely that the observations about the broader pedestrian environment would have been made. Therefore, in interpreting Madison's pedestrian crash data, it is important to approach the analysis with a critical eye, evaluating the type, quality and extent of the data available.

With this caveat in mind, the 1991-1995 *Pedestrian Crash Report* summarizes the current pedestrian crash situation in Madison based, on an analysis of police crash reports:

- Of the approximately 5,500 traffic crashes reported to the Madison Police Department each year, only about 111 (2.0%) involve pedestrians. From 1991-1995, 556 pedestrian crashes were reported.
- During this time, there were 44 traffic fatalities, including 17 pedestrians (38.6% of all traffic fatalities were pedestrians and 3.1% of pedestrian crashes were fatal). Of these 17 fatalities, 9 involved alcohol use by either the pedestrian or motorist and 5 specifically involved pedestrian alcohol use. Pedestrians over the age of 65 were involved in only 6% of all pedestrian crashes, but they accounted for 25% of the pedestrian fatalities during this period.
- 60.1% of pedestrian crashes occurred during daylight hours. 27.7% occurred during hours of darkness in locations where there were no lights. For children 5 to 9 years old, 81.6% of all crashes occurred between noon and 6:00 p.m. This time period was also significant for crashes involving children 10 to 14 years old (55.8%). For young adults (20-24), 48% of all pedestrian crashes happened at night.
- The majority of pedestrian crashes occurred on arterial streets (58%). Also, 20% of crashes happened in off street locations including sidewalks, driveways and parking lots. More than half of these happened in commercial parking lots.

< The most common crash types[2] in Madison between 1991 and 1995 were:

Pedestrian dart out	36.1%
Vehicle turning	12.6%
Vehicle backing, on & off street	8.6%
Driver violation	7.9%
Driver moving forward in commercial parking lot	5.0%
Pedestrian crossing against signal	4.7%
Insufficient information/other at intersection	3.1%
Walking along roadway	2.5%
Insufficient information/other at midblock	2.3%

< Between 1991 and 1995, in Madison there were 14 crashes (2.5%) involving pedestrians walking along the street. There were sidewalks at 10 of these sites, but the pedestrians were not using them. Only four of the crashes happened during daylight and three pedestrians were facing traffic. There was no evidence of alcohol use by either the pedestrians or the motorists.

< About 14% of the crashes were hit and run, most of which happened during hours of darkness. Approximately 25% of the hit and run crashes occurred in commercial parking lots.

< Statewide data indicate that 5-9 year olds, who comprise 7% of the state's population, account for 17% of pedestrian crashes. In Madison, however, this age group accounts for 5% of the population and 7% of the crashes.

< In Madison between 1991 and 1995, for children between 5 and 9 years old, running into the street without looking for traffic accounts for 94% of midblock crashes and 90% of intersection crashes (93% of all on street crashes). Similarly, for children 10 to 14 years old, 87.5% of midblock crashes and 56.2% of intersection crashes happened when the pedestrian darted out into the street (72% of all crashes). [It should be noted that pedestrian crashes typically classified as dart outs are based on driver statements like, "all of a sudden, the pedestrian appeared out of nowhere." Information about the relative locations of the pedestrian and the motorist at the time the pedestrian entered the roadway is usually not collected. Typically, these crashes are reported as the pedestrian darted out into the street rather than that the motorist failed to yield to the pedestrian. The pedestrian may indeed have darted into the street, but the way these crashes are typically classified does not typically acknowledge that the motorist may have failed to yield to the pedestrian.]

< For children between 5 and 9 years old, crashes are evenly distributed along local and

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[2]Note: Crash types are not intended to indicate fault. The types merely categorize crashes based on common situations regardless of which party was at fault.

arterial streets. For children between 10 and 14 years old, 66% of all crashes occurred on arterial streets. For young adults, arterial streets are still significant sites for crashes (60%), but off street crashes are more significant than for other groups (13.5%).

For the most part these data seem to confirm expectations - busy streets are a problem, pedestrians darting out or motorists failing to observe and/or yield to pedestrians is a problem, young children play a lot in the afternoon, and young adults stay out late at night. Some trends might mask real problems because none of the data are adjusted for exposure rates.

HAZARDOUS PEDESTRIAN LOCATIONS RECOMMENDATIONS

59. (CONT)	The Traffic Engineering Division shall continue to maintain maps of pedestrian crashes and analyze these data to identify trends and problem locations and crash types, as one element of improving pedestrian facility designs to enhance pedestrian travel.
60. (MED)	The Traffic Engineering Division and the Police Department shall review data requested on the crash report forms to determine if the data currently collected for pedestrian crashes allows for adequate analysis of these crashes and make recommendations for improving these forms based on their analysis.
61. (LOW)	The Madison Metropolitan School District and other educational institutions should use pedestrian crash data to develop education programs to improve pedestrian safety.
62. (CONT)	The Traffic Engineering Division shall continue to use pedestrian crash data along with more proactive measures to modify pedestrian facility designs to improve pedestrian safety.
63. (LOW)	The Police Department shall use pedestrian crash data to develop enforcement programs targeted at both motorists and pedestrians to improve pedestrian safety.

Maintaining Walkway Continuity during Building, Road and Utility Construction

Road, building and utility construction projects often create unavoidable interruptions to the pedestrian network. Generally, the only accommodations made for pedestrians are signs indicating "use other side." However, sometimes pedestrians choose walking in the street rather than "using the other side" because crossing the street twice to go around the construction site is inconvenient.

Sometimes pedestrians choose to walk in the street rather than 'using the other side' because crossing the street twice to go around the construction site is inconvenient.

Sometimes these signs will be posted at the intersection prior to the blockage to encourage the pedestrian to cross the street at the previous intersection. If the construction site is visible from this point, this advance warning can be helpful. However, observations of pedestrians indicate that if the construction site is too far ahead, they will often proceed without crossing the street, hoping when they reach the construction site, they might find some way to squeeze through, especially if their destination is on the same side of the street as the construction site.

Vehicular traffic can also be impacted by long term road and building construction projects. The roadway might be narrowed by one or more travel lanes, but usually access is maintained. If necessary, a temporary road around the construction site is sometimes constructed. The "use other side" signs used for pedestrians are equivalent to simply posting "road closed" signs for the vehicular traffic. Just as convenient alternative routes are typically provided for motorists when roads are closed, convenient access should be maintained for pedestrians around the construction site as well.

Observations indicate that pedestrians will often walk in the street, through the construction site or through mud and snow in the terrace rather than crossing the street to use the other side despite the "sidewalk closed" signs.

Some cities maintain a pedestrian access around/through construction sites by using concrete barricades to create a pedestrian corridor.

WALKWAY CONTINUITY DURING CONSTRUCTION RECOMMENDATIONS

64. (HIGH)	Traffic Engineering shall require contractors to maintain pedestrian access through/around construction sites in a way that minimizes the interruptions to normal pedestrian access and the need for pedestrians to cross the street.

Pedestrian Facility Funding

Developers are responsible for costs related to installing pedestrian facilities in new developments (MGO 16.23(9)(d)(6)). Property owners in already developed areas without sidewalks pay for the initial sidewalk installation. Sidewalk reconstruction costs are split 50/50 between the property owner and the City. In addition, the City pays for intersections and retaining walls.

Citizen requests are often the impetus for efforts to construct sidewalk sections in areas where they are currently missing. In addition, the City sometimes recommends sidewalk installation as part of street reconstruction projects. Many discussions about whether or not to install a sidewalk where one does not currently exist turn into heated debates. The people who want the sidewalk typically argue that sidewalks are a vital element of accessible, convenient, safe and enjoyable walking routes. The people who don't want the sidewalks typically argue that they don't want to pay for them or maintain them, that they will alter the character of the neighborhood and that they bought their house specifically because it does not have a sidewalk.

This is a debate which is occurring nation-wide with a focus on who pays for sidewalks. Mankato, Minnesota, for example, has recently made the transition from property owner to City responsibility for sidewalk installation costs. They considered two possible alternatives in their deliberations. The first would charge each property owner with a flat annual rate per tax parcel (suggested $10/yr). New sidewalks and replacements would be installed with 50-50 matching assessments between the City and property owner.

The second option, which Mankato considered and adopted, incorporates sidewalks into the standard rate on all street replacement, per an adopted sidewalk/trails plan and map, with special emphasis near schools and parks. Property owners pay a flat rate per foot for sidewalks (at the same ratio as for streets). The City picks up costs of curb cuts, intersections, retaining walls and other bigger ticket items.

PEDESTRIAN FACILITY FUNDING RECOMMENDATIONS

65. (LOW) The Transportation, Public Works and Planning and Development Departments, along with the Comptroller shall work together to investigate funding options for pedestrian improvements to replace, supplement, or otherwise modify reliance on special assessments to property owners.

Education

Educational efforts are a vital component of any coordinated approach to making Madison an even better place to walk. Education encompasses a wide variety of elements. Most commonly when people think of pedestrian transportation education, they think of pedestrian behaviors, and more specifically educating children about issues such as how to cross the street safely. This certainly is an important component of educational efforts related to pedestrian issues, but a comprehensive approach will go significantly beyond this. Within the pedestrian target group alone, there are many additional educational projects that could be pursued. For example, all pedestrians could benefit from an educational program targeted at how to interpret the flashing DON'T WALK signal.

Motorist and bicyclist behaviors with respect to how they interact with pedestrians is another clear potential target for educational efforts to make Madison an even better place to walk. Beyond pedestrian, motorist and bicyclist behaviors, a comprehensive pedestrian transportation education program will also target design professionals responsible for designing pedestrian facilities and police officers responsible for enforcing traffic laws.

These educational programs utilize many tools to reach their specific target audiences. Coordinated media campaigns through the print, broadcast, and electronic media can be an appropriate mechanism for some messages. Other educational programs might be better implemented through school curricula, drivers education courses, workshops, brochures, web pages, videos or other innovative educational techniques.

Another component of developing and implementing education programs that enhance the pedestrian environment and increase the opportunities to choose walking as a viable transportation mode is to make sure that citizens are be aware of these programs and can readily participate in those programs relevant to them.

The National Highway Transportation Safety Association suggests many possible education activities in its publication, *Law Enforcement Pedestrian Safety*:

1. Create a media packet. Include information about pedestrian laws, high risk behaviors, national and local statistics, and particularly dangerous intersections or areas of your community. Distribute the package to daily and weekly newspapers, radio, television and community bulletins.
2. Have a media conference sponsored by the Chief of Police, the City Traffic Engineer and the City Engineer. Involve the mayor and other politicians as well as community leaders. Hold the media conference at a time when pedestrian issues are more likely to gain attention, either before the end of school or before school opens.
3. Sponsor a Pedestrian Safety Week/Month.
4. Place an article in the newspaper asking the public to identify the most hazardous area(s) in the community for pedestrians.

5. Police agencies can play the role of 'training the trainers' about pedestrian safety information. It is not necessary that police officers be sent to every classroom or to every civic organization, but the police can teach those who teach children or who serve the needs of older adults. These new 'trainers' will spread the word about pedestrian safety.

6. Develop, print, and distribute basic handout materials describing pedestrian safety, what to do, what not to do, what the law says, identify dangerous behaviors, etc.

7. Attach a brochure about pedestrian safety to all traffic citations.

8. Ask the public transit agency to include pedestrian safety information on the exteriors and interiors of their buses.

9. Include a section on pedestrian laws, rights and obligations in driver's test and driver education programs.

10. Since most drivers also walk, appeal to them from both perspectives - how do they behave toward pedestrians when they are driving, and how do they expect a driver to behave toward them when they are walking.

11. Ask public utilities or banks to include pedestrian safety information in monthly mailings. Ask the Bureau of Motor Vehicles to include this information with automobile registration renewal notices.

Pedestrian Education

Issues to Address

Many people, regardless of travel mode, have a laissez-faire attitude about following laws regulating their behaviors. People's desire for 'freedom' to choose to do as they feel is safe is as relevant to when people are walking as to when they drive.

Since laws requiring motorists to yield to pedestrians in crosswalks are frequently not observed nor enforced, many pedestrians feel they must do what is expedient, whether or not it is legal. In addition, people's awareness of their legal rights and responsibilities when they are motorists and pedestrians is often limited. Many people do not have a clear understanding, for example, of when and where it is legal for pedestrians to cross the street, when motorists are required to yield to pedestrians and when this responsibility is reversed, or what unmarked crosswalks are and what they mean for pedestrian and motorist rights and responsibilities.

Pedestrian crashes usually involve a behavioral error on the part of the pedestrian, the motorist, or both. Sometimes pedestrians dart out into the street without stopping or looking for traffic or they cross at intersections without checking for turning traffic. In many cases, motorists, whether going straight or turning, fail to yield to pedestrians in crosswalks.

Another problem is that pedestrians and motorists often do not understand the meaning of the flashing 'DON'T WALK' signal. When the signal begins to flash DON'T WALK, if a pedestrian has already entered the crosswalk, s/he should continue across the street. In this

situation, motorists are still obligated to yield to pedestrians. If, however, the pedestrian has not yet begun to cross the street when the signal begins to flash 'DON'T WALK' then s/he should wait until the next WALK cycle to cross. Observations indicate some pedestrians turn around and go back to the curb from where they started if the pedestrian signal begins to flash DON'T WALK while they are in the crosswalk. Other pedestrians enter the crosswalk even though the pedestrian signal is already flashing DON'T WALK because they have found that they can usually still make it across before the vehicular traffic signal changes. In addition, pedestrians sometimes complain that when the pedestrian signal begins to flash DON'T WALK motorists are often less likely to yield to pedestrians in the crosswalk and are more likely to challenge the pedestrian's right to be crossing the street.

The National Bicycling and Walking Study's Case Study No. 12, *Incorporating Consideration of Bicyclists and Pedestrians into Education Programs*, indicates there are a number of topics typically covered in elementary schools that have pedestrian safety programs:

- Locating the edge of the road
- Search procedures before entering the road midblock
- Search procedures when there are visual screens
- Search procedures at intersections
- Search procedures when there are parked cars
- Search procedures while crossing the road
- Meaning of signal lights and signs.

The case study also outlines some topics that are covered less frequently:

- Wearing something light or bright to be conspicuous
- Using crosswalks
- Planning a safe route
- Walking along the road (procedures when there are no sidewalks)
- Walking in parking lots
- Judging gaps in traffic (including understanding distance and time considerations and reaction time)
- Safety considerations in bad weather
- Types of vehicles sharing the roadway - cars, trucks, school buses, bicycles.

Groups to Carry Out Pedestrian Education Efforts

Madison Public Schools and Parochial Schools

Schools should play an important role in planning and conducting a community pedestrian safety program. They should establish an instruction program that will foster the knowledge, skills and attitudes necessary for safe walking. Walking is the main transportation mode used by school-aged children, so pedestrian safety instruction should be as important as learning the rules of the road in driver's education.

Very little is done in Madison's high schools to promote pedestrian safety. Madison's 1982

Pedestrian Bicycle Safety Plan outlines several ideas for overcoming this shortcoming that are still appropriate today. "First, health and physical education courses should add walking or jogging to their curriculum. Second, pedestrian rights and responsibilities should be taught and emphasized in driver's education classes. Materials have been developed for this purpose by the State of Wisconsin Department of Transportation. There should, moreover, be a required amount of time dedicated to this subject, and it should be uniform from school to school. Third, a driver's education refresher course should be offered by high schools to juniors and seniors."

University of Wisconsin-Madison

Many of the university's more than 40,000 full-time students rely on walking for transportation. As the area also experiences particularly high volumes of motor vehicle and bicycle traffic, the potential for conflicts between pedestrians and motorists is particularly high. This is a particularly large, concentrated pedestrian population that could be targeted for pedestrian education efforts aimed at all mode users.

Media: Television, Radio, Newspaper

Television stations could include pedestrian safety as a topic for their news casts and talk shows. They could also undertake larger projects about pedestrian safety such as a series of safe walking and driving tips incorporated weekly into their news casts. Television stations could also provide air time for pedestrian-related public service announcements.

Radio stations should include pedestrian safety as a topic for their talk shows and interviews. They could provide greater coverage of walking and running events. In addition, they could also provide air time for pedestrian-related public service announcements.

Newspapers could print articles about pedestrian safety targeted not only at pedestrians, but also at motorists and bicyclists. Staff editorials relevant to pedestrians could be printed periodically on such matters as enforcing laws affecting pedestrian safety, promoting walking for transportation, and development patterns that encourage walking. The newspapers could have a traffic safety specialist write a regular pedestrian column.

Programs in Other Cities

Lexington Kentucky provides two full-time police officers to operate their 'Safety City' education program. As NHTSA describes, "The curriculum at Safety City is approved by the Board of Education and includes classroom instruction and practical exercises for second graders. The second graders take closely monitored walking trips and have an opportunity to see vehicle safety from behind the wheel of a three mph battery powered mini-car. Second graders were chosen for the program because educators say this is the age when children begin to use reasoning powers. Presently, Safety City serves all of Fayette County public and private schools. The program has developed a student workbook, 'Graduate of Safety City' buttons, and bumper stickers. A videotape and a publicity folder are available to communities interested in learning more about the program."

Albuquerque, New Mexico operates the Albuquerque Crash Reduction Effort (ACRE)

Program. “The ACRE program promotes cooperation among the three traffic safety E’s: enforcement, education and engineering and also fosters communication with the media and the judiciary. ACRE includes a school based curriculum where off-duty officers make presentations to first graders. A coloring book on traffic safety will soon be added to the curriculum. A unit in the traffic division analyzes crash data, enabling police to target high crash locations for enforcement efforts.

“The media has helped to publicize the Albuquerque Police Department “City Kitty” cars, which enforce traffic laws. Although the department has only four of these eye-catching white mustangs, the public reportedly perceives that the department has as many as a hundred, because the program is very visible and has been promoted by the media.

“In the future, ACRE hopes to establish regular meetings between police officers and judges to foster communication and to discuss how to present traffic cases to prove the elements of the offense. Police also plan to implement an educational program with neighborhood associations in which police officers meet with parents and their children to instruct them about safe street crossing skills.

“Funding for ACRE comes from a $3.00 fee that the state legislature approved and added to traffic tickets. Monies raised from this fee are earmarked for the State Highway Department’s Traffic Safety Education and Enforcement Fund, which is used in part to fund local traffic safety programs.”

Many pedestrian studies have been performed by various government agencies, particularly the National Highway Traffic Safety Administration, and based on these studies, materials have been developed for various school-aged groups. The National Bicycling and Walking Study’s Case Study No. 12, *Incorporating Consideration of Bicyclists and Pedestrians into Education Programs*, reports, “Probably one of the most successful of these programs is NHTSA’s *Willy Whistle* film which has recently been updated as a video and renamed *Stop and Look With Willy Whistle*. That program is oriented toward young children in kindergarten through third grade and teaches the critical behaviors needed to avoid the so-called ‘dart-out’ [crash]. The video emphasizes basic stop and search procedures, including stopping at the curb, looking left-right-left until no cars are coming, and then crossing the street while continuing to search until safely on the other side. It also points out that, when parked cars are present, the child should make sure the cars are empty and not about to move, then go to the edge of the car and stop and search as before. The City’s Bicycle Safety Coordinator uses this video in his presentations to elementary school students.

“A companion video called *Walking With Your Eyes* is a recent update of another successful NHTSA film called *And Keep On Looking.* That video, oriented toward children in grades four through six, starts with a review of the critical stop and search procedures needed to avoid ‘dart-out’ [crashes]. It then adds procedures to follow at intersections when there are traffic lights or pedestrian signals and when there are visual screens that block the driver’s and pedestrian’s view of each other. The video also covers procedures to follow in parking lots and covers cues that indicate that a parked car might start to move.”

Motorist Education

Like pedestrians, motorists and bicyclists have fairly low regard for pedestrians laws. A recent AAA study, cited in Oregon's Bicycle and Pedestrian Plan, found that nearly 50 percent of motorists were unaware of basic pedestrian laws. Those that are actually aware of the law figure they won't get detected much less caught, so why follow them.

Motorists exceeding the speed limit are unlikely to consider the implications of this behavior on the likely outcome if they hit a pedestrian. Also, some motorists turn without looking for pedestrians whose path they are crossing, particularly in right-turn-on-red situations. Further, some motorists probably do not think about pedestrians when they run red lights. In addition, it is common that motorists ignore the law requiring them to yield or to stop for pedestrians in marked and unmarked crosswalks.

In an effort to try to address the speeding issue some years ago, the Hillsboro-West End Neighborhood Association in Nashville helped to put on a "Thank You for Not Speeding" day at one of their cut-through streets badly plagued by the problem.

City traffic officials and police were nervous, at first, and even told the group they would be liable to arrest if they "blocked traffic." The official's principle concern was to keep the cars moving rather than the neighborhood's worries about their children.

The group carried picket signs and handed out leaflets. The leaflets were friendly and positive, telling people that they were welcome to cut through, just please do not speed through. The group kept to the side of the street (no sidewalks) and did not attempt to hinder vehicles.

Some drivers stopped to talk with the residents, and the response they heard again and again was "Well, you know, I just never thought about it."

The neighborhood had good press and mostly positive comments. (There were the inevitable drivers who sat down on their gas pedal just to show whose street it really was.) Unfortunately, the good effects lasted only for a short while. Today the street is a candidate for one of the first experimental traffic calming devices in Nashville.

Bicyclist Education

Of particular concern for interactions between pedestrians and bicyclists is how these two modes share sidewalks and multi-use paths. Pedestrians are often frustrated by bicyclists who pass by them very quickly and very closely without warning. Bicyclists in return are sometimes frustrated by pedestrians who walk side by side and leave no space for bicyclists to get by.

On sidewalks, the law clearly defines how pedestrians and bicyclists should interact. Pedestrians have the right of way. Bicyclists, where they are legally allowed on the sidewalk, are guests and are required to yield the right of way to pedestrians.

For multi-use paths, on the other hand, there is no standard etiquette for how pedestrians and bicyclists should interact in these situations. Some pedestrians go to the extreme of saying bicyclists and pedestrians simply do not mix and that bicyclists should not be allowed where

pedestrians are allowed. Common sense goes a long way in considering how bicyclists and pedestrians should interact on sidewalks and paths. Common courtesy suggests bicyclists should slow down and leave plenty of room so as to be less likely to frighten an unsuspecting pedestrian. Likewise, pedestrians should remain alert to other path users and leave space for approaching bicyclists to pass. Several model ordinances have been proposed that would legally establish these rights and responsibilities.

Other issues concerning interactions between bicyclists and pedestrians on sidewalks and paths are not as straight forward. For example, opinions vary widely as to whether bicyclists should sound a bell, say something or remain silent as they approach a pedestrian. Also, some pedestrians think they should walk on the left to best see approaching bicyclists, whereas others walk on the right and view bicyclists and pedestrians mixing as analogous to cars and bicyclists sharing the roadway.

Design Professional Education

In order to improve their knowledge of pedestrian facility design, construction and maintenance issues, the City should develop a systematic approach for raising design professional, City staff and commission awareness of pedestrian issues. See the 'Working Knowledge of Pedestrian Issues' in the 'General Planning Considerations' section at the end of this chapter for further discussion.

Law Enforcement Officer Education

The methods by which police agencies train officers and place them in traffic assignments impacts the effectiveness of pedestrian safety programs. Training programs need to explain and emphasize the reasons why pedestrian law enforcement is important.

The National Highway Traffic Safety Administration in its publication, *Law Enforcement Pedestrian Safety,* suggests several approaches for training law enforcement officers.

- *Media promotion*: Use the same safety messages communicated to the general public via TV, radio, or brochures to train police officers about pedestrian law enforcement.
- *Pedestrian Safety Articles*: Place articles about pedestrian safety and pedestrian law enforcement countermeasures in police memos or bulletins.
- *Enforcement Videotape*: Encourage the state police organization to develop a pedestrian safety education and enforcement videotape. The videotape can be distributed throughout the state and can be shown at roll call. The videotape should educate the officers about pedestrian safety problems and should emphasize the Police Department's commitment to pedestrian law enforcement.

Enforcement efforts by police officers need to be backed up by the Judiciary.Without this support, enforcement success will be minimal. Judges should be informed about the Police Department's and the community's commitment to pedestrian safety so they will be more likely to uphold tickets and give appropriate sentences.

EDUCATION RECOMMENDATIONS

66. (CONT) Traffic Engineering shall continue to make pedestrian safety resource materials available to citizens and visitors.

67. (MED) Traffic Engineering and the Police Department shall encourage the school systems, colleges and University of Wisconsin to include pedestrian safety courses in their regular course curricula.

68. (HIGH) The City of Madison shall strive to continue to maintain a Pedestrian/Bicycle Coordinator and a Pedestrian/Bicycle Safety Educator on staff.

69. (LOW) Each agency implementing pedestrian transportation education programs shall include an evaluation component that monitors how well these programs are reaching their target audiences.

70. (LOW) The Police Department and Traffic Engineering shall increase their efforts to develop and implement educational programs for pedestrians, motorists and bicyclists that promote safe and courteous interactions between these modes.

Pedestrian Education:

71. (LOW) The Police Department and Traffic Engineering shall work toward developing and implementing educational programs targeted at pedestrian understanding of pedestrian signals, including the flashing DON'T WALK signal, and pedestrian push buttons.

Motorist Education:

72. (MED) The Madison Metropolitan School District and private schools should include appropriate pedestrian safety information and educational opportunities in their driver's education courses and elementary grade curricula.

73. (LOW) The Police Department and Traffic Engineering shall work toward developing and implementing educational programs targeted at motorist understanding of 1) their responsibility to yield to pedestrians in crosswalks, 2) the seriousness of exceeding the speed limit and implications for pedestrian injuries and fatalities in crashes, and 3) how running red lights and failing to yield to pedestrians before turning right on red impacts pedestrian travel.

Bicyclist Education:

74. (LOW) The Police Department and Traffic Engineering shall work toward developing and implementing educational programs targeted at bicyclist and pedestrian understanding of how bicyclists and pedestrians should interact on sidewalks and multi-use paths.

Design Professional Education:

See recommendations under 'General Pedestrian Planning Considerations'**.**

Law Enforcement Officer Education:

75. (HIGH) The Police Department shall include in its officer training programs information about the issues concerning pedestrian safety, the importance of pedestrian and traffic law enforcement, and the role the officers play in promoting pedestrian safety.

Encouragement

Strong pedestrian facilities, education programs and law enforcement efforts will go a long way toward enhancing the pedestrian environment and increasing the opportunities to choose walking as a viable transportation mode. Even more people can be encouraged to walk if these efforts are combined with promotional programs and materials. Such programs can cover many facets of encouraging people to walk.

As with education programs, coordinated media campaigns can play an important role in efforts to encourage walking. Such campaigns increase the visibility of walking in the community, thereby helping to promote walking as a viable transportation mode. Possible themes for these campaigns include the health, neighborhood livability and environmental benefits of walking, profiles of a variety of community residents for whom walking is a way of life, or celebrity interviews as spokespeople and advocates for walking. Outlets for such campaigns include newspaper articles, print media ads, TV and radio interviews, feature stories, PSAs, print and TV ads, and web pages. Another possible project would be to develop a traveling display and slide show or video to promote heightened awareness of pedestrian issues for use at such locations as schools, neighborhood association meetings, shopping centers, libraries and employment centers.

Events to promote and encourage walking can complement coordinated media campaigns. Special events can be organized during September for National Pedestrian Month. Special neighborhood walking tours for residents and tourists can be an effective way to promote a neighborhood's walkability. Also, the City should continue to support neighborhood events, parades and block parties being held in the street.

In addition to these efforts, transportation demand management techniques including incentives for employers, employees, and customers can also encourage more people to walk. For employers, the City could offer tax breaks to employers who encourage their employees to walk to work, or the City link some types of conditional use requests with incentive programs to promote walking. The City could also give out awards to employers who provide particularly alternative transportation friendly environments.

Employers can provide many different types of incentives to encourage their employees to walk to work. For example, employers can offer flex time, casual dress days, or transportation allowance programs. Providing showers and lockers can also help to promote walking. Employers could also organize an employee walking competition and offer awards in such categories as most miles walked in a particular time period or most days in a row walked.

Finally, businesses can provide incentives to encourage their customers to arrive on foot. For example, discounted entrance fees could be offered at major sports events, concerts and expositions for attendees who arrive by walking, bicycling, or using transit. Alternatively, stores could provide discount coupons to customers who arrive by foot.

	ENCOURAGEMENT RECOMMENDATIONS
76. (LOW)	The City of Madison shall investigate providing incentives for employers to encourage their employees to walk to work.
77. (MED)	Neighborhood associations should develop and implement neighborhood walking tours.
78. (LOW)	Traffic Engineering shall work toward developing and implementing coordinated media campaigns to encourage walking.
79. (MED)	Employers should consider offering incentives to their employees to encourage them to walk to work.
80. (MED)	Businesses should investigate offering incentives to customers who arrive by foot.

Enforcement

Pedestrian Enforcement

For pedestrians, the most common enforcement issue is jaywalking, or illegally crossing the street. Jaywalking can include crossing the street against a traffic control device, stepping out in front of moving traffic so as to present immediate danger, and crossing at an intersection outside of a crosswalk.

Some pedestrians make a case for using discretion in interpreting these offenses. Crossing

against a traffic control device can be a safety hazard for both pedestrians and motorists. However, crossing against a traffic control device does not always result in a pedestrian endangering himself/herself or a motorist. It is in these situations that the desirability of issuing citations is questionable.

At signalized intersections where there are no pedestrian signals, pedestrians may legally cross the street against the traffic signal if s/he does not interfere with other traffic. But when there are pedestrian signals, pedestrians may legally enter the crosswalk only if the signal shows WALK. However, there are often gaps in traffic adequate for pedestrians to cross while the pedestrian signal is displaying DON'T WALK. Because they can cross without endangering their or the motorist's safety, some pedestrians will choose to cross against the signal.

A similar situation arises with pedestrian actuated signals, where pedestrians must push a button to activate the pedestrian walk cycle. If pedestrians arrive at a pedestrian actuated signal just as the traffic signal in their desired direction of travel turns green, some pedestrians consider the delay required by law to push the button and wait for the next cycle to be excessive. In this situation some pedestrians will choose to cross against the signal. In addition, many pedestrians will weigh their safety against pedestrian delay when there are long gaps in the traffic flow when a pedestrian signal shows DON'T WALK. When a pedestrian determines s/he can significantly reduce delay without compromising his/her safety, s/he will sometimes choose to cross the street against a DON'T WALK signal. Pedestrians take these actions because they follow common sense. Ticketing pedestrians in these situations seems unlikely to change behavior, while at the same time likely to foster pedestrian animosity for adhering to laws in general.

Crossing the street at an intersection outside the crosswalk is another component of jaywalking for which judicious interpretation should be applied. This stipulation is included in order to target people who try to walk diagonally across intersections. Unless there is a pedestrian only phase, when pedestrians cross an intersection diagonally they will likely come in conflict with traffic that has the assigned right of way at that time. However, this type of behavior is not the only situation that leads to pedestrians walking outside the crosswalk. Especially on corners where there is a diagonal curb ramp, the crosswalks are often not marked in a way that pedestrians, particularly those using wheelchairs, can maintain a path that keeps them within the boundaries of the marked crosswalk.

Motorist Enforcement

Several motorist violations have particularly significant impacts on pedestrian safety. The chances of pedestrian fatality increases exponentially as motorist speed increases. Therefore, a motorist exceeding the speed limit or driving too fast for conditions can have fatal consequences for a pedestrian. Motorists failing to yield to pedestrians in crosswalks is also a significant problem for pedestrians, especially in heavy traffic where there are few gaps in traffic adequate for crossing. Pedestrian delay can be excessive in these situations if motorists

fail to yield. Also, if crossing opportunities are too infrequent, pedestrians are more likely to try cross in gaps that are less than ideal, increasing their risk of being involved in a crash. Two additional problems are motorists running red lights and motorists failing to yield to pedestrians before turning right on red. In both of these cases, the motorist is likely cutting off the pedestrian despite the pedestrian having a WALK signal. In some cases, the duration of the motorist violation will last through the entire WALK cycle (especially on wide streets where this phase is sometimes 4-7seconds), making it impossible for the pedestrian to cross the street legally.

Likelihood of Pedestrian Fatality in Crash

Motorist Speed (mph)	Chance of Pedestrian Fatality
20	5%
30	45%
40	85%

Programs in Other Communities

According to NHTSA, "Seattle's pedestrian law enforcement program began with a highly publicized public education campaign emphasizing pedestrian rights and responsibilities. The campaign was, and continues to be, coordinated by Harborview Injury Prevention Center, which is affiliated with a research and teaching hospital. Education takes the form of public service announcements, newspaper articles, radio spots, billboards, and bus posters. The Seattle Police Department stresses that its program is not a jaywalking campaign and that the main concern of its pedestrian law enforcement program is pedestrian safety with an emphasis on pedestrian protection. Information and education is extended to the public so that it will become aware of the laws and will in turn voluntarily comply with them. The citizens are also made aware that, if they do not obey the laws, whether they are a motorist or a pedestrian, they will receive a ticket."

"Seattle is planning to require a traffic response to every pedestrian crash, regardless of severity, that will include an in-depth investigation. The investigation will examine, for example, whether environmental factors contributed to the crash, whether the driver or the pedestrian needed but did not wear eye glasses, and how the pedestrian was clothed (e.g., wore dark colors). [These] data will be analyzed with an eye toward identifying problems and potential solutions. Police officers will ask the driver and the pedestrian to voluntarily take a breath test to determine if alcohol was a factor in the crash."

ENFORCEMENT RECOMMENDATIONS

81. (HIGH) The Police Department shall encourage consistent and regular enforcement of traffic laws that enhance pedestrian safety by routinely citing violations by both pedestrians and motorists.

General Pedestrian Planning Considerations

Pedestrian-Related Ordinances

Four chapters of the Madison General Ordinances (MGO) deal directly with pedestrian related issues: Chapter 10: Streets, Alleys, Sidewalks and Gutters; Chapter 12: Vehicle Code; Chapter 16: General Planning; and Chapter 28: Zoning Code. No systematic review of these regulations has ever been conducted to evaluate pedestrian implications. These chapters are briefly summarized below and some ordinances are discussed in greater depth in later sections of this chapter that deal with the specific issues they address. It should be noted that the analysis of the ordinances presented in this chapter is only a cursory review and that a more comprehensive analysis should be conducted at a future date to determine how consistently they direct City agencies and commissions to provide for accessible, convenient, safe and enjoyable pedestrian travel, and to evaluate how well they are being implemented.

Chapter 10: Streets, Alleys, Sidewalks and Gutters

Chapter 10 of the Madison General Ordinances addresses a number of issues relevant to pedestrians. In summary, sections 10.06 and 10.09 deal with sidewalk construction and repair; sections 10.23, and 10.25-10.27 indicate prohibited sidewalk uses; section 10.28 spells out the City's policy on snow and ice removal from sidewalks; section 10.29 specifies that downspouts and eaves of buildings cannot drain onto sidewalks; section 10.08 covers the construction of driveways and parking lot facilities; and section 10.39 covers the City's policy on street light installation including addressing pedestrian safety at night.

Chapter 12: Vehicle Code

Whereas Chapter 10 addresses the physical configuration of pedestrian facilities and the need to keep these free of obstructions to pedestrian travel, the Vehicle Code regulates people's behaviors. In summary, the vehicle code defines acceptable behaviors related to such issues as requiring motorists to yield to pedestrians in crosswalks, prohibiting driving on sidewalks, defining where bicycling is permitted or prohibited on sidewalks, prohibiting pedestrians from using controlled access highways, and outlining the respective rights and duties of motorists, pedestrians and bicyclists.

It is this chapter that the City of Madison has the least ability to change because City Ordinances related to the Vehicle Code must follow State Statutes except where specific authority to differ from the State Statutes has been granted to local units of government. Any changes the City would like in the Vehicle Code would either have to be in compliance with State Statutes, or would have to be made at the state level before being adopted by the City. It should be noted that the State and City Vehicle Codes substantially follow the Uniform Vehicle Code, a national model for state and local traffic laws. Therefore, Wisconsin's and Madison's Vehicle Codes are similar to those in other states.

Chapter 16: General Planning

Chapter 16 of the Madison General Ordinances covers general planning provisions. These provisions are designed to "regulate and control the subdivision of land...in order to promote the public health, safety and general welfare of the community. They are designed to lessen congestion in the streets and highways...to facilitate adequate provision for transportation...schools, parks, playgrounds and other public requirements" (16.23(1)).

Within this ordinance, the general requirements for subdivisions [16.23(3)(a)5] notes that "The City of Madison subscribes to a policy that urbanizing land should desirably be located in a compact manner...where arrangements for public transportation will minimize the impact of commuting automobile traffic on City residents..." Subdivision policies include "favor[ing] land use intensities and patterns that are supportive of alternative modes of transportation."

Section 16.23(3)(a)6 indicates that subdivisions will not be approved unless it is determined that "adequate public facilities and public services are available to support and service the area of the proposed subdivision...." In terms of transportation, the adequacy of existing roads, additional roads or roadway improvements, public mass transportation and the recommendations of the Department of Transportation and the Regional Transportation Study are reviewed.

Section 16.23(8) specifies design standards for streets and alleys, including their arrangement. Subsection 6e specifies that "public walkways or sidewalks shall be installed within all public right of ways and public walkway easements unless the Plan Commission...determines that the public walkways are not required."

Chapter 28: Zoning Code

The Madison Zoning Code defines what land uses are allowed in what types of zoning districts. Several intents and purposes of the code are pertinent to pedestrian travel (28.02): to lessen congestion in the public streets; to facilitate the adequate provision of transportation, water, sewerage, schools, parks and other public requirements; to encourage the most appropriate use of land throughout the City and environs; and to protect the character and maintain the stability of residential, commercial and manufacturing areas within the City and environs, and to promote the orderly and beneficial development of such areas.

28.08 Residence Districts		
R1	Single-Family Residence District	Established to stabilize and protect the essential characteristics of certain low density residential areas normally located in the outlying urban parts of the City, and to promote and encourage a suitable environment for family life where children are members of most families. Single-family dwellings, low density multiple-family dwellings in planned residential developments, and certain recreational facilities to serve residents of the district.
R2	Single-Family Residence District	Single-family dwellings, low density multiple-family dwellings in planned residential developments, and certain recreational facilities to serve residents of the district.
R3	Single-Family and Two-Family Residence Districts	Single-family and two-family dwellings, low density multiple-family dwellings in planned residential developments, and certain community and recreational facilities to serve residents of the district.
R4	General Residence District	Uses limited to certain residential and institutional uses, such as single-family, two-family and multiple-family dwellings, and convalescent homes, and certain community and recreational facilities to serve residents of the district
R5	General Residence District	R4 + apartment hotels
R6	General Residence District	Highest density residential areas normally located in the central part of the city, and to promote and encourage, insofar as compatible with the intensity of land uses, a suitable environment for a predominantly adult population, and in those central areas located in close proximity to the central campus of the UW, to promote and encourage a suitable environment for student housing facilities.

28.085 Office Districts		
28.09 Commercial Districts		
C1	Limited Commercial District	Established to accommodate the shopping needs of residents residing in adjacent residential areas. Within this district, which is located in close proximity to residential areas, are permitted those uses which are necessary to satisfy the daily or frequent shopping needs of the neighborhood customer. [convenience goods and personal services]
C2	General Commercial District	Established to accommodate the shopping needs of a much larger consumer population and area of residency than that served by the C1 district. Within this district, which is located in relative proximity to residential areas and to major thoroughfares, is permitted a wider range of uses than in the C1 district...Unlike C1, there is no limitation on the size of the establishments. [C1 + durable and fashion goods]
C3	Highway Commercial District	Within this district are permitted those uses which because of certain locational requirements and operational characteristics are appropriate to locations either in close proximity to major thoroughfares or in areas away from residences. [includes animal hospitals]
C4	Central Commercial District	Established to accommodate those uses which are of City-wide, regional or state significance.
28.10 Manufacturing Districts		
28.106 Historic Districts		

Working Knowledge of Pedestrian Issues

Many City staff and commission members have little, if any, formal training related to pedestrian issues because universities typically do not offer any courses that specifically cover pedestrian facility design, construction and maintenance, or effective pedestrian education, encouragement and enforcement programs. What working knowledge they do have often comes from personal observation and experience.

There are an increasing number of opportunities for City staff and commission members to receive outside training by attending conferences and workshops. Federal Highway Administration, Livable Communities, and Alex Sorton from the Traffic Institute at Northwestern University regularly offer pedestrian workshops. There are also several

professional conferences that regularly address pedestrian issues: The National Pedestrian Conference, ProBike/ProWalk, the Transportation Research Board annual conference, and the Institute for Transportation Engineers annual conference.

In order to improve the working knowledge of pedestrian issues, the City should develop a systematic approach for raising City staff and commission member awareness of pedestrian issues and adopted City pedestrian vision, goals, objectives, and guidelines.

Transportation Improvement Program & Capital Budget

Street improvement projects are prioritized and scheduled for implementation through the Dane County Regional Plan Commission's Transportation Improvement Program (TIP) and the City's Capital Budget. The TIP lists projects six years into the future. Both are updated annually. These lists include new construction, reconstruction and spot improvement projects. Pedestrian improvements are often included within a larger project's scope. Stand alone pedestrian improvement projects are also included. Coordinating pedestrian improvements with larger projects will increase the likelihood of implementation. In addition, it costs less to implement pedestrian improvements as part of a larger project than as a stand alone project. Currently, there is limited formal review of Transportation Improvement Program and Capital Budget projects with respect to desired pedestrian improvements.

GENERAL PEDESTRIAN PLANNING RECOMMENDATIONS

Pedestrian-related Ordinances:

NOTE: Issues related to each of these chapters in the Madison General Ordinances are discussed in greater detail in the following sections. Rather than suggesting specific ordinance changes here, relevant recommendations are made under each specific topic.

82. (MED) The Long-Range Transportation Planning Committee shall analyze the Madison General Ordinances to determine how consistently they direct City agencies and commissions to provide for accessible, convenient, safe and enjoyable pedestrian travel, and shall evaluate how well they are being implemented. Based on this analysis, the committee shall make recommendations to improve City ordinances and their implementation that will enhance pedestrian travel.

Working Knowledge of Pedestrian Issues:

83. (HIGH) Traffic Engineering shall distribute copies of the *Pedestrian Transportation Plan* to City staff and commission members as an educational tool to raise their awareness of pedestrian issues and adopted City pedestrian vision, goals, policies, objectives, and standards.

84. (HIGH) Traffic Engineering shall encourage WisDOT to sponsor pedestrian training programs for engineers, planners, architects, landscape architects and developers.

85. (MED) Department and Division heads shall encourage City staff involved in planning, design and/or maintenance of pedestrian facilities to attend conferences and workshops that offer training related to pedestrian issues within available training resources.

86. (MED) The City Disability Rights Coordinator shall consider making arrangements for periodic pedestrian facility tours for City engineers and planners to enhance their understanding of pedestrian facility design considerations for people with disabilities.

87. (HIGH) Department and Division heads, when hiring staff involved in planning, design and/or maintenance of pedestrian facilities, should consider including relevant pedestrian knowledge/skills/abilities as a desired qualification and questions about pedestrian experience and issues in the interview process.

Transportation Improvement Program & Capital Budgets:

88. (HIGH) The Departments of Planning and Development, Transportation and Public Works shall consider pedestrian improvements in their on-going transportation planning processes.

89. (HIGH) City Engineering, Traffic Engineering and Madison Metro shall review the projects in the Transportation Improvement Program and the Capital Budget each year for desired pedestrian improvements and shall take these recommendations into account as they develop their annual work programs.

90. (HIGH) The Pedestrian-Bicycle-Motor Vehicle Commission, Long-Range Transportation Planning Committee, the Transit Parking Commission, the Citizen's Advisory Council on People with Disabilities, the Plan Commission and the Board of Public Works shall review the projects in the Transportation Improvement Program and the Capital Budget each year for desired pedestrian improvements and shall take these recommendations into account as they develop their annual work programs.

91. (HIGH) City Engineering, Traffic Engineering and Madison Metro shall include desired pedestrian facility improvements within the scope and budget of transportation improvement projects included in the Transportation Improvement Program and the Capital Budget.

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