Hawaii Pedestrian Toolbox

MAY 2013

This guide is a companion document to the Hawaii Statewide Pedestrian Master Plan

A Guide for Planning, Design, Operations, and Education to Enhance Pedestrian Travel in Hawaii

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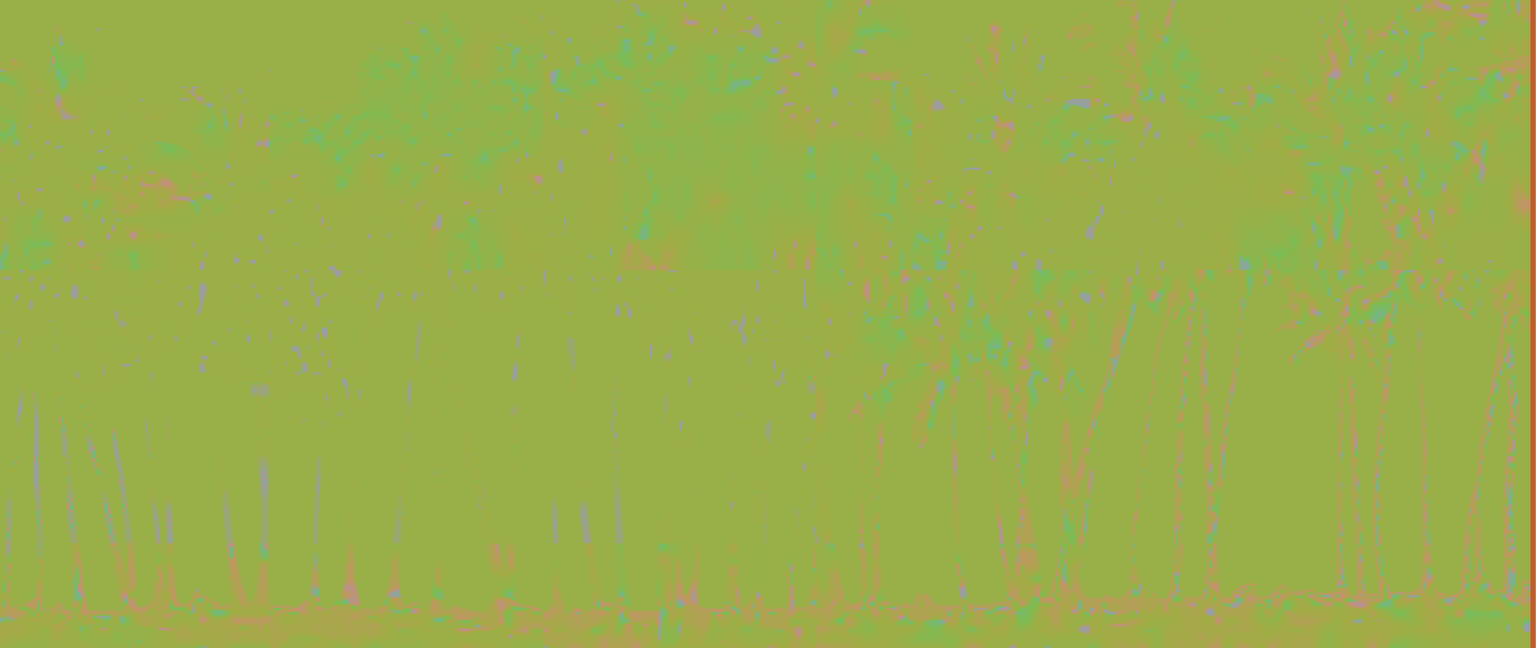


HAWAII PEDESTRIAN TOOLBOX

A Guide for Planning, Design, Operations, and Education to Enhance Pedestrian Travel in Hawaii

TABLE OF CONTENTS

INTRODUCTORY SECTIONS

HAWAII PEDESTRIAN TOOLBOX

SECTION 1

SECTION 2

SECTION 3

Introduction

Many people walk in Hawaii—residents, tourists, students, children, people with disabilities, and older adults—and all need well designed pedestrian facilities.

INTRODUCTION

Why a Pedestrian Toolbox?

The Hawaiian Islands are home to more than 1.3 million people, and over 6 million more people visit the islands each year, drawn by the scenic beauty, tropical climate, and relaxed atmosphere. Because these residents and visitors walk to and from destinations each day for transportation, fitness, and recreation, they have an important need for safe, reliable, efficient, convenient, and attractive pedestrian facilities.

We are all pedestrians at some point each day, and for some of us, especially children, walking is our primary mode of transportation. Whether we walk several miles a day, use a wheelchair to get from our office to the bus stop, ride a skateboard through the park, or simply walk across the parking lot from our car to the grocery store entrance, all of us have a need for well-designed and properly functioning pedestrian facilities. Pedestrian facilities are essential to complete, healthy, and livable communities.

As a companion document to the Statewide Pedestrian Master Plan, the Hawaii Pedestrian Toolbox presents best practices (national and international) for planning, design, and operation of pedestrian facilities based on a compilation of adopted guidance from around the world. The toolbox also provides guidance for education, enforcement, and encouragement to enhance pedestrian travel in Hawaii.

The toolbox directly supports the policy framework (vision, goals, and objectives) of the Statewide Pedestrian Master Plan and addresses many of the specific issues raised in the Areas of Concern analysis that was part of the process of developing the statewide plan. The toolbox is organized into subject matter sections that practitioners can quickly reference to find the guidance they need for their projects.

We are all pedestrians at some point each day.

IN THIS SECTION

- *WHY A PEDESTRIAN TOOLBOX?*
- *TAILORED TO HAWAII'S CHARACTERISTICS AND CONTEXT*
- *WHO WILL USE THE PEDESTRIAN TOOLBOX?*
- *WHAT IS THE FOCUS?*
- *REFERENCES AND OTHER RESOURCES*

TOOLBOX USERS

PRIMARY:

- *Traffic, transportation, and civil engineers*
- *Planners (land use and transportation)*
- *Urban designers, landscape architects, and architects*
- *Other design professionals*
- *Site development and building permit review staff*
- *Developers*

SECONDARY:

- *School districts*
- *Neighborhood councils and planning committees*
- *Metropolitan planning organizations*
- *Central business district planning organizations and main street groups and businesses*
- *Officials and politicians*
- *Representatives from special campaigns and programs*
- *Law enforcement officers*
- *Pedestrian advocates*

Tailored to Hawaii's Characteristics and Context

The guidance in each toolbox section has been specifically tailored to the needs and characteristics of pedestrians in the Hawaiian Islands and the various contexts across the State of Hawaii, including local conditions found on each island. Planners and practitioners in Hawaii will be able to reference these best practices and adapt the guidance to fit their projects.

The intent is to provide a comprehensive document that can be applied under a wide variety of applications and diverse conditions in Hawaii. Implementation of this guidance will improve pedestrian accessibility, mobility, connectivity, and safety.

Who Will Use the Pedestrian Toolbox?

The design guidelines provided in the toolbox will assist staff from the Hawaii Department of Transportation (HDOT), counties, and cities, as well as private developers, planning and design professionals, and others, in planning, designing, constructing, and maintaining pedestrian facilities in a variety of settings, including urban, suburban, and rural communities throughout Hawaii.

Pedestrian access to the waterfront is an important need in many communities in Hawaii.

What is the Focus?

The focus of this toolbox is on **planning and design of pedestrian facilities**, but best practice recommendations and guidelines also are provided for operations, as well as for implementing effective education and promotion programs.

References and Other Resources

The technical information contained in this toolbox was compiled from numerous sources. In some cases, other documents or sources of information were researched and specifically adapted for the toolbox based on input from the advisory committees and other technical experts involved. Readers interested in additional information related to specific types of pedestrian facilities will find a list of relevant sources at the end of each toolbox section.

PURPOSE OF THE HAWAII PEDESTRIAN TOOLBOX

- *To promote best practices throughout the state and achieve a broader-scale, positive change in the pedestrian environment*
- *To provide consistency in pedestrian design guidance*
- *To provide comprehensive guidance in a number of pedestrian-related topics*

Supports Hawaii's "Complete Streets" Objectives

WHAT ARE PEDESTRIAN FACILITIES?

Sidewalks, walkways, paths, trails, intersection treatments, crosswalks, signing, signals, actuation, curb ramps, grade separated structures, and traffic calming are all examples of pedestrian facilities. Other features, treatments, and strategies to encourage and enhance pedestrian travel and maximize safety are also addressed in the toolbox.

How to Use this Toolbox

A highly visible, marked crosswalk in Honolulu

HOW TO USE THIS TOOLBOX

How Should the Information in the Toolbox Be Used?

This toolbox presents best practices for pedestrian planning, design, operation, and education. The information is provided to help practitioners implement projects and improvements to better serve pedestrians' needs throughout the State of Hawaii.

The information presented in this toolbox may not solve all problems associated with pedestrian travel, but it provides a "first step" in establishing a consistent set of statewide guidelines for pedestrian facilities. Information in the toolbox also can be used to help facilitate consensus on sometimes differing approaches to design.

Applying the Guidance with Flexibility

This toolbox provides a combination of standards and guidelines that allows for flexible and innovative approaches. The best practices need to be applied on a case-by-case basis and adapted to fit each project's conditions. Standards are required that either mandate or prohibit specific practices, while guidelines are more flexible. In all cases, the guidance in this toolbox must be applied in conjunction with other applicable local, regional, state, and federal requirements and guidelines. Refer to page H-2 and H-3 for more information.

The guidance in the toolbox applies to typical situations encountered during project planning, design, and development. Unique design problems sometimes require flexibility in design solutions.

Pedestrians are everywhere in Hawaii—in urban, suburban, rural, natural, and resort settings.

IN THIS SECTION

STANDARDS vs. GUIDELINES

The guidelines that are presented throughout the toolbox are the preferred design approaches to use in Hawaii. However, some design provisions are mandatory, some are strongly encouraged, and some are optional. Look for these language usages to understand the degree of flexibility in design:

- *Required: Look for the words "shall" or "shall not," and "must" or "must not." Also look for the words "is required" or "are required."*
- *Recommended: Look for the words "should" or "should not." The words "preferred," "encouraged," or "recommended" may also be used.*
- *Optional: Prescribed options or optional treatments use the words "may" or "may not."*

Relationship to Other Guidelines and Standards

Counties in Hawaii and the City and County of Honolulu may have other adopted standards and guidelines related to design of pedestrian facilities that may supersede the guidance in this toolbox. In that case, this toolbox can be used to complement the locally-adopted guidance. There may be useful information here that is not covered in as much detail elsewhere.

All pedestrian facilities must be planned, designed, and built in accordance with existing federal, state, and local standards as applicable. In some situations, the current standard may not be achievable due to geometric, environmental, or other constraints. In these situations, variances from the standard may be acceptable. However, a facility should not typically be built to less than the minimum standards described. Deviations from standards should be documented and justified through special studies. Deviations must be approved by the agencies that have jurisdiction over the project.

THIS TOOLBOX IS JUST ONE OF MANY SOURCES OF GUIDANCE

Be sure to check with local, regional, state, and/or federal jurisdictions responsible for or involved in your specific project to confirm requirements.

Reference documents that guide state and local design in Hawaii include:

- ***Standard Details for Public Works Construction, Revised September 2000***
- ***Standard Plans, HDOT Highways Division, 2008***
- ***Hawaii Standard Specifications for Road and Bridge Construction, 2005***
- ***Standard Uniform Design Standards for Streets and Highways, 1980***

Interpreting Guidance on Dimensions in the Toolbox

Guidance on dimensions in the toolbox is often presented in terms of “desirable,” “minimum,” or "maximum" dimensions. These recommendations should be applied with professional judgment to achieve the best solutions that are specifically tailored to the circumstances encountered. For example, if a sidewalk receives a high amount of use, the project designer or local design reviewer may elect to apply the “desirable” dimension over the “minimum” for the sidewalk width.

Where Can You Find the Information You Need in the Toolbox?

Pedestrians in Hawaii

This introductory section provides information about pedestrian use and statistics throughout the State of Hawaii.

General Characteristics and Needs of Pedestrians

This introductory section provides information about the characteristics and needs of pedestrians in general, as well as those of various types of pedestrians. Understanding these characteristics and needs will help guide planning, design, operation, and education decisions.

Pedestrian Toolbox/Toolbox Sections

The toolbox provides recommendations under eleven topics organized into sections. A directory of these toolbox sections is provided on the first page of the toolbox for easy reference. Toolbox Section 1—Thinking about Pedestrians from the Start—Creating Pedestrian-Friendly Communities provides a general overview of planning and design considerations related to pedestrians and creating pedestrian-friendly communities. The other toolbox sections provide more specific design guidance related to a number of key topics that will be helpful to practitioners.

Other Resources

Relevant sources of information and references are listed at the end of each toolbox section.

Glossary

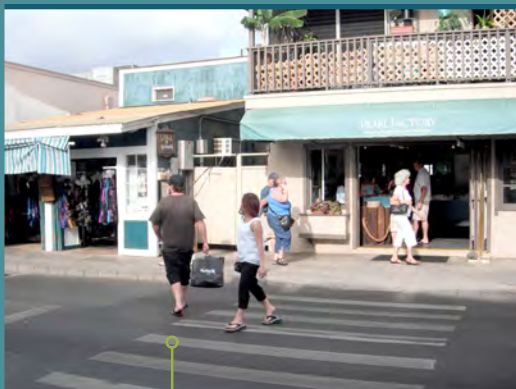
A glossary is also provided after the toolbox. Terms and acronyms related to pedestrian facilities addressed in the toolbox are defined and described.

OTHER DOCUMENTS TO REVIEW

FOR PLANNING, DESIGN, AND OPERATION OF PEDESTRIAN FACILITIES

- ***Local design standards, zoning codes and development codes, including city and county standard plans and provisions***
- ***Hawaii DOT policies, standard plans and provisions, specifications for road and bridge construction, and uniform design standards for streets and highways***
- ***Americans with Disabilities Act (ADA) Federal Requirements***
- ***Manual on Uniform Traffic Control Devices (MUTCD), Federal Highway Administration, USDOT***
- ***Guide for the Planning, Design and Operation of Pedestrian Facilities, American Association of State Highway and Transportation Officials, AASHTO***
- ***Guide for the Development of Bicycle Facilities, AASHTO***
- ***A Policy on Geometric Design of Highways and Streets (the Green Book), AASHTO***
- ***A Guide for Achieving Flexibility in Highway Design, AASHTO***
- ***International Building Code (IBC), International Conference of Building Officials Uniform Code, and locally adopted building codes***

Note: This is only a partial list and does not include all available resources. Refer to the end of each toolbox section for other relevant publications.



Even small towns and villages need well designed pedestrian facilities.

There are many attractive walking routes in Hawaii.

Index

The index at the end of this document provides an alphabetical listing of subject headings and words to help you quickly find information about specific topics.

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Sources and references for images and graphics are noted throughout this document. Sources are typically not cited for photographs and illustrations provided, adapted, and/or created by the author of the toolbox and other direct contributors to its development.

LOOK FOR THE BOXES

Important and helpful information and checklists are highlighted in graphic boxes like this one throughout the toolbox

LIVE LINKS TO WEBSITES

Live links (hyperlinks) to websites, accessible to people viewing the content electronically, are located throughout the toolbox. These hyperlinks, active at the time of publication, are shown in bold, purple, italicized text. Readers can click on each hyperlink and follow instructions to access the website. For example:

State of Hawaii Department of Transportation

English to Metric Conversion Chart

Dimensions are shown in English units throughout the document with metric equivalents following in parentheses. An English-to-metric conversion chart is provided below for easy reference purposes.

INCHES	MULTIPLY BY	EQUALS NO.	UNIT
1	25.4	25.4	millimeters
2	25.4	50.8	millimeters
3	25.4	76.2	millimeters
4	25.4	101.6	millimeters
5	25.4	127.0	millimeters
6	25.4	152.4	millimeters
7	25.4	177.8	millimeters
8	25.4	203.2	millimeters
9	25.4	228.6	millimeters
10	25.4	254.0	millimeters
FEET	MULTIPLY BY	EQUALS NO.	UNIT
1	0.305	0.305	meters
2	0.305	0.610	meters
3	0.305	0.915	meters
4	0.305	1.220	meters
5	0.305	1.525	meters
6	0.305	1.830	meters
7	0.305	2.135	meters
8	0.305	2.440	meters
9	0.305	2.745	meters
10	0.305	3.050	meters

MPH	MULTIPLY BY	EQUALS NO.	UNIT
10	1.61	16.1	Kilometers/hour
20	1.61	32.2	Kilometers/hour
30	1.61	48.3	Kilometers/hour
40	1.61	64.4	Kilometers/hour
50	1.61	80.5	Kilometers/hour
MILES	MULTIPLY BY	EQUALS NO.	UNIT
1	1.61	1.61	kilometers
2	1.61	3.22	kilometers
3	1.61	4.83	kilometers
4	1.61	6.44	kilometers
5	1.61	8.05	kilometers
6	1.61	9.66	kilometers
7	1.61	11.27	kilometers
8	1.61	12.88	kilometers
9	1.61	14.49	kilometers
10	1.61	16.10	kilometers

Honolulu sidewalks are filled with pedestrians on a daily basis.

Visitors, who often don't rent vehicles, frequently rely on walking as a primary mode of transportation.

Pedestrians in Hawaii

Pedestrians in Hawaii have a wide diversity of needs.

PEDESTRIANS IN HAWAII

This introductory section to the Hawaii Pedestrian Toolbox highlights statistical information and important considerations related to pedestrians in the Hawaiian Islands. Understanding the needs of pedestrians and factors that affect pedestrian travel is important when designing pedestrian facilities and developing pedestrian programs.

Pedestrians Defined

Merriam-Webster defines the term "pedestrian" as: going on foot; and: of, relating to, or designed for walking (e.g. *pedestrian* traffic or a *pedestrian* mall).

The Hawaii Revised Statute (291C-1) defines a "Pedestrian" as:

> *"any person afoot, in a wheelchair, or in a vehicle propelled by a person afoot."*

a "Sidewalk" as:

> *"that portion of a street between the curb lines, or the lateral lines of a roadway, and the adjacent property lines, intended for use by pedestrians."*

and a "Safety Zone" as:

> *"the area or space officially set apart within a roadway for the exclusive use of pedestrians and which is protected or is so marked or indicated by adequate signs as to be plainly visible at all times while set apart as a safety zone."*

According to state statute, a pedestrian may include anyone who is either walking or using an electronic or human-propelled personal assistive mobility device (self balancing, two-wheeled device designed to transport one person with a maximum speed of 12.5 mph). This includes people in wheelchairs and personal wheeled devices, as well as children riding on small bicycles, scooters, and skateboards.

Throughout the toolbox, when the terms "pedestrian activity," "walking," or "walkability" are used, they are meant to relate to any pedestrians, whether on foot or using a wheelchair or other personal wheeled device.

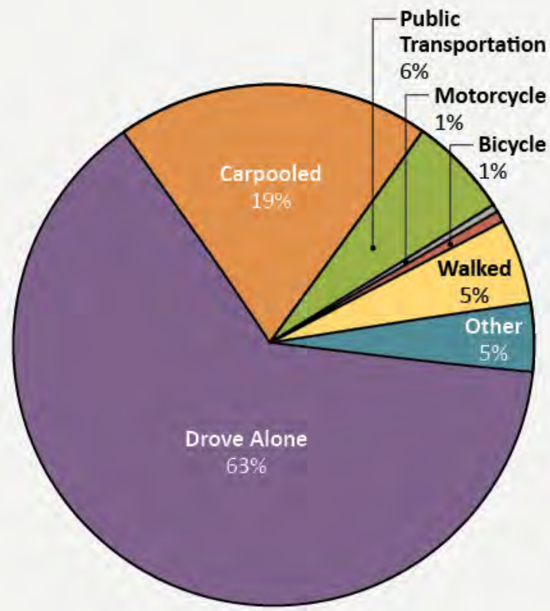
IN THIS SECTION

Levels of Pedestrian Activity in Hawaii

According to the 2000 Census, only about 6 percent in Hawaii either walked (4.4 percent) or bicycled (1.6 percent) to work, while 82 percent drove to work alone or carpooled. (Refer to Exhibit P.1.) According to the 2010 Benchmarking Report, published by the Alliance for Biking and Walking and based on the 2009 National Household Travel Survey (NHTS), 8.2 percent of all trips to work (commute trips) in Hawaii were by made by bicycling or walking, compared to the national level of 9.6 percent. The report also indicates that Hawaii ranks sixth overall in the nation for the number of people who walk to work.

The 2010 Benchmarking Report estimates that 7 percent of all trips in Hawaii are on foot. However, it is unclear if this statistic represents purely the resident population or also includes the visitor population (nearly seven times greater than the resident population). Given the influx of visitors, mild climate, and other factors, the number of all trips made by walking in Hawaii is likely to be above the national average. In fact, results from a 2007 household survey on Oahu indictate that

EXHIBIT P.1 Means of Transportation to Work



Source: Statewide Pedestrian Master Plan, HDOT, with data from the 2000 Census

About 5 percent of pedestrians in Hawaii walk to work, according to the 2000 Census.

14.2 percent of all trips by residents and visitors were made by biking or walking. This compares with a national average of 12 percent for biking and walking trips as a percentage of total trips.

According to the 2009 NHTS, there are an estimated 42 billion walking trips nationwide every year. To put this statistic in perspective, Americans take a total of about 388 billion annual trips with walking trips making up roughly 10.9 percent of all trips. Because every trip begins and ends as a pedestrian trip—whether walking to a bus stop or across a parking lot to the car—we are all pedestrians at some point each day.

Exhibit P.2 summarizes how Hawaii compares to other states in the nation in various categories related to pedestrian and bicycle activity.

Important Factors that Affect the Need for Pedestrian Facilities

There are many factors that affect pedestrian activity and the need for pedestrian facilities. These factors will continue to influence how people travel in Hawaii in the coming years.

Population Growth and Tourism

Hawaii's population grew from about 1.1 million in 1995 to 1.36 million in 2010. The population is projected to grow to 1.72 million by 2020. This rise in population will bring greater pressures on natural resources related to human impacts and increasing demand on Hawaii's transportation system.

Tourism is Hawaii's foremost industry and leading employer. In 2010, more than 7 million visitors came to the Hawaiian Islands, and the visitor population is growing throughout the state. This influx of visitors also places an extensive, increasing demand on the state's transportation system.

Providing a variety of transportation options, including pedestrian, bicycle, and transit facilities, will help Hawaii serve this growing demand while also minimizing impacts to the environment and sensitive resources in the islands.

Diversity

Pedestrians in Hawaii are diverse—they come from many countries and cultures and speak and read a variety of languages. They include people of all ages, young and old, and people of

EXHIBIT P.2 Pedestrian and Bicycle Statistics for the State of Hawaii

	AVERAGE IN HAWAII	AVERAGE OF ALL STATES NATIONWIDE	
Percent of All Trips to Work by Pedestrians and Bicyclists[2]	8.2%[1]	9.6%	↓
Percent of Federal Transportation Dollars Spent on Ped/Bike	1.23%	1.58%	↓
Percent of Federal Safety Dollars Spent on Ped/Bike[2]	5.7%	0.6%	↑
Percent of Safe Routes to School Funding Obligated	17%	40%	↓
Percent of all Traffic Fatalities that are Pedestrians or Bicyclists	20.34%	13.56%	↓
Percent of Youth Ages 10-17 Who are Obese or Overweight[2]	28.5%	34.6%	↑
State Ped/Bike Staff (in FTEs)[2]	1.5	4.9	↓
Complete Streets Policy	Yes	26 States	↑
Share the Road Safety Campaign[2]	Yes	33 States	↑

Source: Alliance for Biking and Walking, 2012 Benchmarking Report
[1]Source: 2009 Household Interview Travel Survey in Hawaii / 2010 Benchmarking Report
[2]Source: 2010 Benchmarking Report

LEGEND

↓ Lower than or Worse than National Average

↑ Higher than or Better than National Average–Exceeding Benchmark

Walkability is an important ingredient of livable communities.

Pedestrians stroll through Chinatown on Oahu, Hawaii.

varying physical stature and capability. A higher proportion of older adults live in Hawaii compared to other states, largely because many retirees are drawn to the mild climate and attractive environment. Some pedestrians have mobility and sight impairments and other disabilities. (Refer to the special needs of younger and older pedestrians and pedestrians with disabilities described in the "General Characteristics and Needs of Pedestrians" section. See also Toolbox Section 3—Accessibility.)

People of all income levels live in Hawaii, and the incidence of poverty in some communities affects peoples' capability to buy and maintain vehicles. Throughout the islands there are various households with no access to vehicles and residents who rely on walking as their main transportation mode. In addition, most visitors who come to Hawaii choose not to rent a car and have limited access to personal vehicles. Many walk to and from their destinations, along with riding available transit systems and taking part in local tour programs.

Considering the diversity of pedestrians in Hawaii is important when planning and designing facilities to accommodate their needs.

The Health Crisis

America is facing a national health crisis of epidemic proportions. Physical inactivity combined with unhealthy eating has, in just a few generations, made us a nation of overweight and out-of-shape people. The incidence of overweight or obese adults increased steadily from 47 percent in 1976 to 68 percent in 2007. The prevalence of overweight children and adolescents more than tripled during that same 30-year span, with 19.6 percent of children aged 6-11 and 18.1 percent of adolescents aged 12-19 identified as obese. (Source: *Increasing Physical Activity through Community Design*, National Center for Bicycling and Walking, 2010)

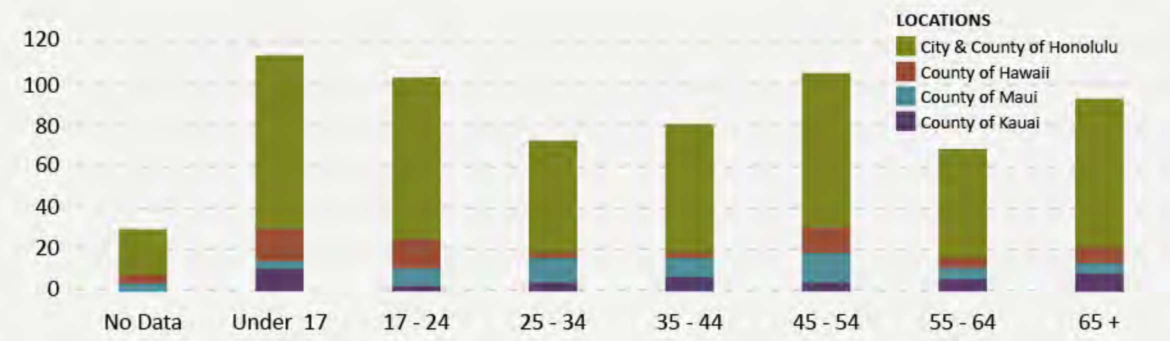
Diseases and health risks related to obesity, including diabetes, heart diseases, hypertension, and stress, are also increasing at alarming rates. About 60 percent of overweight children between the ages of 5 and 10 already demonstrate risk factors associated with disease such as elevated blood levels and insulin levels. These factors can lead to chronic diseases later in life. The direct economic cost of obesity in the US was estimated to be between $80 and $90 billion in 2008.

Overall, residents of Hawaii are generally healthier than those from other states. (For example, 14 percent of students are reported as obese compared to higher levels nationwide.) However, inactivity, obesity and related health risks are still a growing problem in Hawaii. Native Hawaiians have more than twice the rate of diabetes and are 5.7 times more likely to die from diabetes than Caucasians living in Hawaii. Millions of visitors with obesity, diabetes, and other health problems come to Hawaii each year from throughout the nation and abroad. Encouraging people to walk and providing pedestrian facilities to accommodate their needs can increase physical activity and improve public health.

Safety

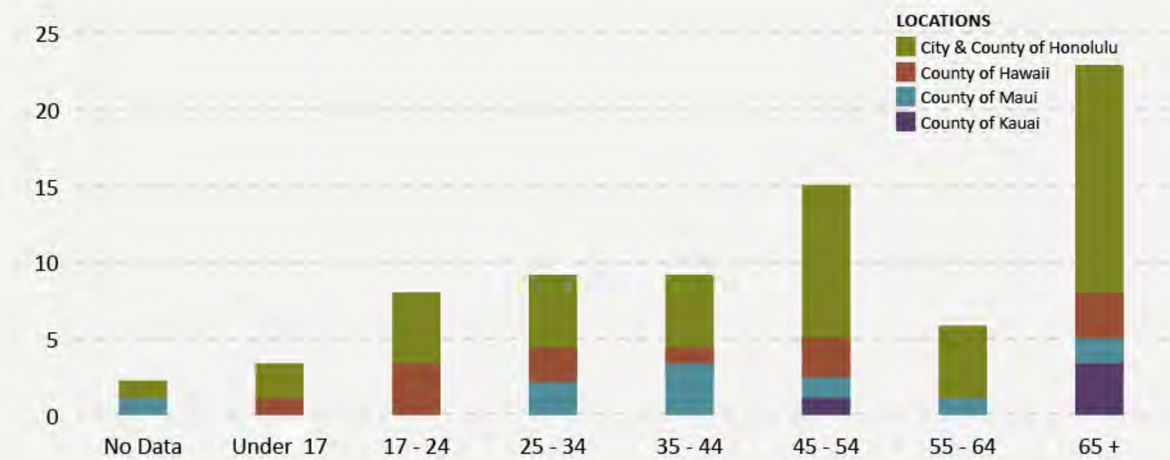
Even though pedestrian activity is estimated to occur in higher levels in Hawaii compared to other states, Hawaii ranks 30th for pedestrian safety (2010 Benchmarking Report). Approximately 21 percent of all traffic fatalities are pedestrians, 6 percent of which are under the age of 16, and 18 percent are over the age of 60. According to the Statewide Pedestrian Master Plan, another source of data, the Hawaii

EXHIBIT P.3 ***Age of Pedestrians Involved in Accidents on State Highways, Statewide, 2004-2008***



Source: HDOT

EXHIBIT P.4 ***Age of Pedestrians Involved in Fatal Accidents on State Highways, Statewide, 2004-2008***

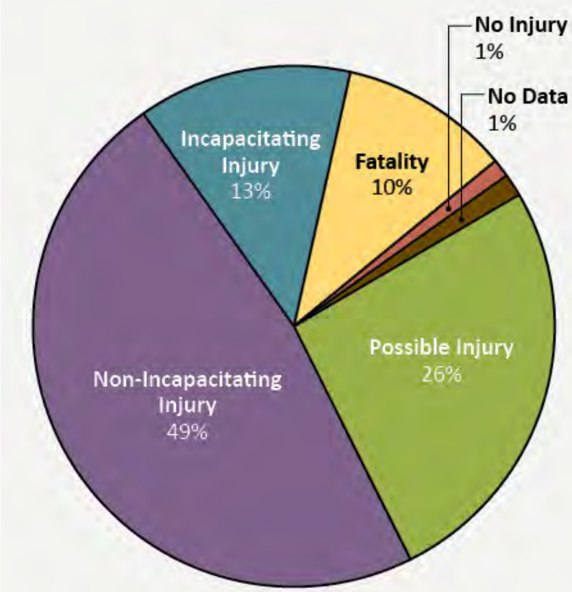


Source: HDOT

Farmers Market at Fort Street Mall, Downtown Honolulu, Hawaii

Pedestrians window shop along Waialae Avenue in Kaimuki, Honolulu, Hawaii.

EXHIBIT P.5 ***Severity of Pedestrian Accidents on State Highways, Statewide, 2004-2008***



Source: Statewide Pedestrian Master Plan, HDOT, with data from the 2000 Census

Strategic Highway Safety Plan 2007-2012, shows that between 2001 and 2005, Hawaii had the fifth highest pedestrian fatality rate nationwide. Among the elderly, Hawaii leads the nation with a rate of 40.2 deaths per 100,000 people 65 years and older, nearly three times higher than that for the rest of the US. A total of 150 pedestrians were killed in Hawaii over the 2001-2005 period, accounting for 22 percent of all traffic fatalities. Another 540 pedestrians are involved in major traffic crashes each year. Senior pedestrians have the highest rates of fatality. The highest rates for non-fatal pedestrian injuries occurred among the 5 to 19 year age range, with especially high rates among 10 to 14 year olds. Exhibit P.3 depicts the ages of pedestrians involved in accidents on state highways during the period of 2004-2008, while Exhibit P.4 shows the age of pedestrians involved in fatal crashes. Exhibit P.5 depicts the severity of crashes involving pedestrians statewide in Hawaii.

Improving pedestrian facilities and broadening awareness of pedestrians' needs across Hawaii should result in less crashes involving pedestrians and improved pedestrian safety overall.

Dependence on Fossil Fuels

Hawaii is the most oil-dependent of all 50 states and relies on imported petroleum for 90 percent of its primary energy. Most of this oil is from foreign nations. Hawaii's residents pay among the nation's highest prices for fuel and electricity. This dependency is increasing. (Source: *Indicators of Environmental Health*, State of Hawaii Department of Health, February 2010)

Encouraging more pedestrian activity and providing pedestrian facilities to accommodate this activity will help to reduce the state's reliance on fossil fuels.

Greenhouse Gas Emissions and Climate Change

Increasing greenhouse gas emissions and the effects of climate change have the potential to severely impact Hawaii's economy, public health, natural resources and environment. In 2007, a state law was passed (Act 234) committing the state to reduce its greenhouse gas emissions, caused mostly by fossil fuel-based electricity generation and transportation uses.

If more people walk and use other forms of transportation besides motor vehicles for their trips in Hawaii, less greenhouse gas emissions will occur, reducing the potential effects of climate change.

Livability

People are demanding a return to more livable communities and neighborhoods across America. Walkability is an important ingredient of livable places. Clean air and water and access to nature and healthy foods also contribute to livability. Providing sidewalks, paths, crossing treatments, and other pedestrian facilities can greatly enhance the walkability and livability of Hawaii's communities and neighborhoods.

Fort Street Mall, Honolulu, Oahu


ONE WAY

General Characteristics and Needs of Pedestrians

People choose to walk for a wide variety of reasons—exercise, recreation, errands, and to get to and from work, school, transit and shopping.

GENERAL CHARACTERISTICS AND NEEDS OF PEDESTRIANS

Understanding Pedestrian Characteristics and Needs

In order to successfully design pedestrian facilities, we must recognize that pedestrian needs are diverse and wide-ranging. Our design approach must be flexible to meet the diversity of their needs.

One common obstacle in design of pedestrian facilities is assuming that one standard can be applied to fit an "average" population. For example, the speed that pedestrians travel can vary greatly, yet pedestrian signals are often timed for average walking speeds of 3 to 4 mph. Children, older adults, and people with certain disabilities typically travel at much slower walking speeds.

This section summarizes the characteristics and needs of pedestrians in general, as well as those of various types of pedestrians.

Characteristics of Pedestrian Travel

Why do People Walk?

Pedestrians travel for a wide variety of reasons. In Hawaii and throughout the United States, pedestrian travel has gained recognition as an important form of transportation. People choose to walk for a wide variety of reasons—for exercise, fitness, and health, to complete personal errands, for recreational purposes, to get to and from work, school, transit and shopping, for environmental benefits and to reduce their carbon footprint, and for many other reasons. The levels of walking related to each purpose vary widely depending on the setting and nearby land uses. Exhibit G.1 lists some of the various types of trips people make as pedestrians.

Various Settings

Different areas in Hawaii experience different levels of pedestrian travel. In certain urban areas, the level of walking is higher. In Honolulu, for example, approximately 7 percent of commute trips are walking trips, compared with

IN THIS SECTION

IMPORTANT NEEDS OF PEDESTRIANS

- *Directness and convenience of the route – it takes them where they need to go (minimizing the time it takes and distance traveled)*
- *Accessible facilities*
- *Safe, secure streets and walking areas*
- *Context sensitive planning and design– nearby places to walk and a transportation network designed for walkability*
- *Visibility and lighting (for day time and night time walking)*
- *Comfort and shelter*
- *Attractive and clean environment*
- *Access to transit*
- *Interesting things to look at while walking and social interaction*
- *Enhanced recreational experience—walking provides access to while also preserving waterfronts and environmental, scenic, historic, and cultural resources*

EXHIBIT G.1 Typical Types of Pedestrian Trips (Why People Walk)

To and from work and school
Social visits and events
Appointments
Health and excercise
Errands and deliveries
Recreation
Extra curricular activities
Combined (recreational walking while shopping)
Multimodal trips (walking to a bus stop)
Walking the dog

Pedestrians along Alii Drive in Kona, Hawaii

the overall estimate of 4.4 percent statewide. The higher rate of walking in urban areas is generally attributed to the higher populations of the cities, as well as the more complete and continuous pedestrian networks and facilities. Exhibit G.2 lists some reasons urban areas typically tend to receive high pedestrian use.

Pedestrian travel is higher in urban areas, but pedestrians are often found in suburban and rural areas, particularly in Hawaii. There is a common misconception that people who live in the suburbs do not walk. Research indicates that this is not the case, particularly in suburban areas that provide an interconnected and continuous system of well-designed pedestrian facilities. University of Washington professor, Dr. Anne Vernez-Moudon's research paper, *Effects of Site Design on Pedestrian Travel in Mixed-Use, Medium Density Environments* found that relatively high numbers of people walk in suburban centers, where adequate pedestrian facilities are provided.

It is also important to recognize that people living in suburban and rural areas travel as pedestrians for different purposes than those

EXHIBIT G.2 Why Urban Areas Receive High Pedestrian Use

Higher density of residences, businesses, and other places
High concentration of origin and destination points
Pedestrian networks and facilities are generally more complete and continuous
More available pedestrian facilities
Traffic congestion
Shopping and services are more accessible
Average trip distances are shorter
Parking too costly or unavailable
Transit service is more readily available

Every trip begins and ends as a pedestrian trip, and particularly in urban areas people are willing to walk more for their daily travel needs.

living in urban areas. Suburban and rural pedestrian trips are often associated with walking to schools or school bus stops, transit bus stops, or for recreation and leisure purposes. Fewer people tend to walk for running errands, shopping, and travelling to community services (although these are common reasons for walking in small town centers and village core areas).

Types of Pedestrian Facilities

According to the *National Survey of Pedestrian and Bicyclist Attitudes and Behaviors*, the majority of pedestrian trips (nationwide) occur either on sidewalks or on paved roads without shoulders. The national survey identified the following types of facilities along with percentages of pedestrians using each.

Sidewalks	45.1 %
Paved roads (no shoulders)	24.8 %
Shoulders of paved roads	8.4 %
Unpaved roads	8.0 %
Paths/trails	5.8 %
Grass or fields	4.9 %
Other	3.0 %

Source: National Survey of Pedestrian and Bicyclist Attitudes and Behaviors

Pedestrian Trip Lengths

The distances pedestrians are willing to travel can vary greatly depending on the setting, nearby land uses, climate and weather conditions, topography, comfort and attractiveness of the route, the purpose of their trip, the time of day, and other factors. Most people will walk longer distances for recreational purposes, but prefer to walk shorter distances when they are commuting or are in a hurry, such as from the bus stop to their office.

According to the *National Survey of Pedestrian and Bicyclist Attitudes and Behaviors*, about 27 percent of walking trips nationwide are less than ¼ mile and about 15 percent are more than 2 miles, with the average length of walking trip being 1.2 miles. Exhibit G.3 depicts the results of the national survey, showing the percent of trip lengths on the most recent day walked of the respondents.

Guidelines for acceptable walking distances are listed below.

- Traditionally, planners strive to locate community facilities, transit stations/hubs,

EXHIBIT G.3 *Percent of Trip Lengths on Most Recent Day Walked*

Source: National Survey of Pedestrian and Bicyclist Attitudes and Behaviors

PEDESTRIAN TRIP FACTS (NATIONWIDE)

- *Pedestrian trips account for 39 percent of all trips less than one mile, ranking second only to private motor vehicle trips*
- *73 percent of all pedestrian trips are less than one-half mile*
- *One out of five trips is work related*

Source:
National Survey of Pedestrian and Bicyclist Attitudes and Behaviors

and other popular pedestrian destinations no more than ¼ from the origin of most pedestrian travel.

- Site designers typically use 300 feet as the maximum distance from parking and site pedestrian circulation to building entrances. Street crossings are typically most effective when located approximately 400 to 600 feet apart in areas heavily used by pedestrians.
- *A Guide to Land Use and Public Transportation* states that pedestrians can be expected to travel about 1,000 feet to and from a bus stop or about 750 feet for mobility impaired. People will walk further to high capacity transit and rail stations—about ⅓ to ½ mile.

Planners and urban designers generally use a rule of thumb of ¼ mile walking distance to and from pedestrian destinations and origins such as shopping areas, community centers, and transit hubs, with a ½ mile walking distance as the general catchment area for community and neighborhood walkability. Refer to Toolbox Section 1—Thinking about Pedestrians from the Start for more information.

It is important to note that in Hawaii, where the climate is mild much of the year and the environment is scenic and attractive, people may be more inclined to walk than in other settings across the nation. But this will be largely dependent upon the completeness and continuousness of the pedestrian network and the level of facilities available for pedestrian use.

Overcoming Impediments to Pedestrian Travel

Research has confirmed a variety of common reasons that contribute to low levels of pedestrian travel. The box on the next page lists some of the most common reasons cited by pedestrians.

COMMON REASONS FOR LOW LEVELS OF PEDESTRIAN TRAVEL

- *Poor facilities; lack of sidewalks/walkways*
- *Failure to provide a contiguous system of pedestrian facilities*
- *Concerns for personal safety*
- *Failure to provide facilities to and from popular origins and destinations*
- *Inclement weather*
- *Poor lighting*
- *Lack of separated facilities*

Source: Measures to Overcome Impediments to Bicycling and Walking, Research Report

Measures to Overcome Impediments to Bicycling and Walking, a case study completed by the Federal Highway Administration in 1993, as part of the *National Bicycling and Walking Study,* cited three primary categories of reasons for not walking:

- Facility deficiencies
- Information or knowledge deficiencies
- Motivational deficiencies

Facility deficiencies include lack of adequate facilities and connectivity. Information or knowledge deficiencies are a result of people not knowing about the level of walking opportunities available to them. Motivational deficiencies have to do with attitudes and behaviors—people not walking because distances between origins and destinations are too long, walking is not convenient, the weather is poor, or they feel uncomfortable or unprotected as pedestrians. In many cases information/knowledge and motivational deficiencies would decrease as a result of improvements to pedestrian facilities and expanding the pedestrian network.

The Need for Improved Pedestrian Facilities

Public opinion surveys have shown that people have a desire to walk and would increase their amount of pedestrian travel if better facilities were available. For example, a national survey conducted by the Harris Poll showed that 59 percent of respondents said they would be willing to walk outdoors or walk more often if there were safe designated paths or walkways. Another survey of 900 students in sixth through twelfth grades in public and private schools (Youth Link Transportation Survey) found that:

- Approximately 75 percent of the students would consider walking or bicycling to school as an alternative transportation mode.
- There are several factors that would cause students to be more likely to walk to school, including safer crossings (25 percent), better lighting (29.7 percent), better sidewalks (36.5 percent), and people to walk with (44.9 percent).

Many other studies conducted at the national, state, regional, and municipal levels across the US have found similar results.

ASK THE FOLLOWING

- *Are there origins and destinations within acceptable pedestrian travel distances that will generate trips?*
    - *Schools and parks*
    - *Shopping areas*
    - *Medical facilities*
    - *Community and recreational centers*
    - *Transit/park-and-ride*
    - *Social services*
    - *Housing*
- *Does the existing street or roadway provide pedestrian facilities?*
- *What is the setting (urban, residential, rural)?*
- *Are there high traffic volumes and speeds that could affect pedestrian use?*
- *Can pedestrians cross without travelling more than 400 to 600 feet (120 to 180 meters) to an intersection or another crossing point?*
- *Are transit or school bus stops located along the roadway with safe access and crossing?*
- *Is there an opportunity to complete a contiguous system by filling in existing gaps?*
- *Are there barriers to pedestrian travel that can be removed or opened (dead-end routes, blocked passages)?*

Forecasting Pedestrian Use

At times, pedestrian facility improvements and expansions are not supported because existing use levels are low. As discussed above, there are several studies that have shown that when facilities are added and improved within a community, more people will walk. Pedestrian travel forecasting methods (discussed in more detail in Toolbox Section 1) may provide a quantitative approach to determining the demand for pedestrian facilities, but this approach shouldn't replace a common sense thought process to determine the necessity for facilities.

The sidebar on the left lists questions that should be asked when considering what types of pedestrian facilities should be developed under various circumstances.

Understanding the Severity of and Reasons for Crashes Involving Pedestrians

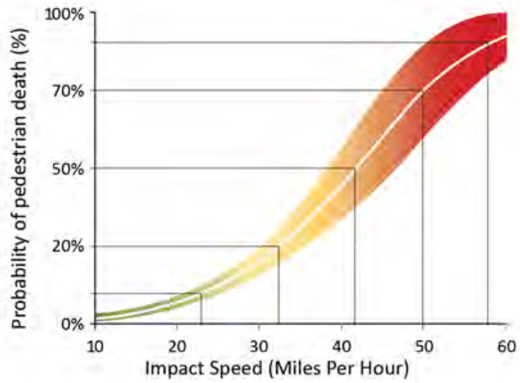
Analysis of pedestrian/motor vehicle crash statistics can help in developing engineering, education, and enforcement solutions.

Most reported pedestrian injuries are a result of crashes with motor vehicles. Vehicle speed is a significant factor in causing fatalities as a result of pedestrian collisions. The faster a motorist drives, the more likely injuries to a person on foot will result in death. The charts in Exhibits G.4 and G.5 illustrate the probability of a pedestrian's death in correlation to the speed of a vehicle involved.

As shown, when crashes occur with the vehicle travelling at a speed of 40 mph, many more pedestrians (85 percent) are killed compared to the number of deaths (45 percent) at a vehicle speed of 30 mph. Only 5 percent of crashes result in pedestrian deaths with vehicle speeds 20 mph. The ability to stop in time for crossing pedestrians significantly decreases as vehicle speed increases, as shown in Exhibit G.6. The higher the speed of travel, the more time required for the driver to stop their vehicle.

Another common reason for pedestrian/automobile collisions is driver inattention or distraction. Pedestrians' failure to use safe behavior when walking and crossing also causes crashes.

EXHIBIT G.4 ***Impact Speed and a Pedestrian's Risk of Injury or Death***
(AAA Foundation for Traffic Safety, September 2011)

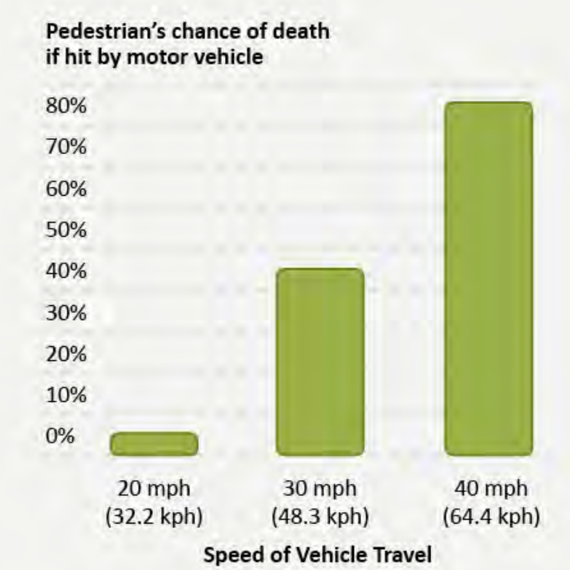


In Hawaii, there is a high incidence of crashes involving pedestrians and motor vehicles at intersections and crossings. A wide variety of conditions are thought to contribute to these incidents making it difficult to identify specific causes, but the state and local jurisdictions are taking strong action to improve safety at intersections and crossings.

The State of Hawaii has adopted specific crosswalk laws for motorists and pedestrians. (Hawaii Revised Statutes 291C-72). The statutes clarify motorists' and pedestrians' responsibilities related to crosswalk use and impose the issuance of fines to those who fail to comply with the requirements.

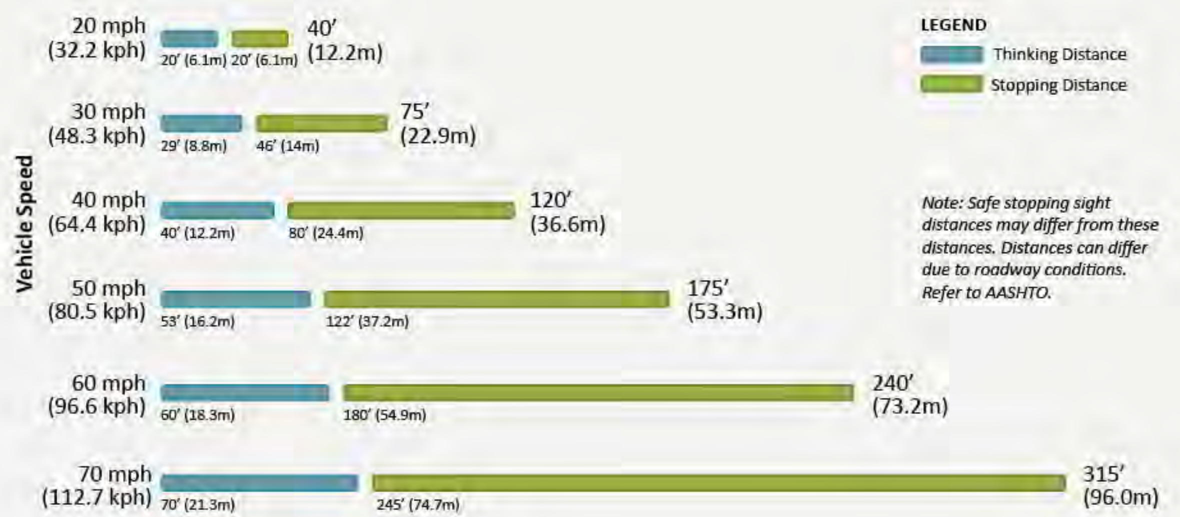
The Honolulu Police Department (HPD) provides pedestrian education, distributing information and talking to pedestrians near intersections. Refer to Toolbox Section 10—Effective Pedestrian Programs for more information.

EXHIBIT G.5 ***Fatalities Based on Speed of Vehicle***



Source: Walk Tall: A Citizen's Guide to Walkable Communities

EXHIBIT G.6 ***Thinking and Stopping Distances Related to Speed of Travel***



Source: Walk Tall: A Citizen's Guide to Walkable Communities; Killing Speed and Saving Lives

In Hawaii, most pedestrian crashes occur in the more urbanized areas. However, a number of crashes involving pedestrians occurred in rural areas, such as along the coasts of the islands of Oahu and Kauai, where pedestrians cross the road to visit parks and beaches. Pedestrian fatalities also follow this trend. Exhibit G.7 lists some of the most common causes of crashes involving pedestrians in Hawaii and nationwide.

By improving pedestrian facilities and implementing pedestrian projects, it is hoped that pedestrian safety will improve and more people in Hawaii will switch their means of transportation to walking for various types of trips. This is one of the important purposes for implementing the Hawaii Pedestrian Toolbox and the Statewide Pedestrian Master Plan.

Pedestrians' Spatial Needs

It is important for designers of pedestrian facilities to consider the basic spatial needs of pedestrians. Exhibit G.8 illustrates approximate human dimensions when walking.

For two people walking side-by-side or passing each other while travelling in opposite directions, the average space taken up is 4 feet 8 inches. This is why a 5-foot sidewalk is not considered to be wide enough for two people to comfortably pass each other. (Shy distance also is needed adjacent to the curb or roadway edge.)

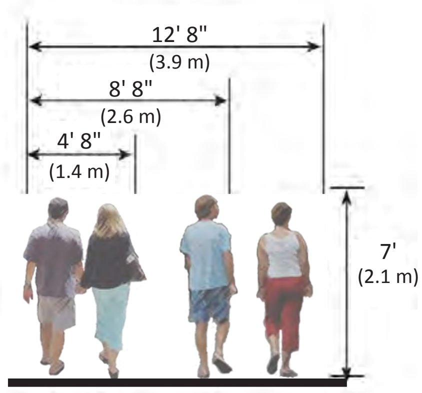
As discussed earlier in this section, pedestrians walk at an average speed of 3 to 4 mph (with children, older adults, and people with disabilities often walking at slower rates). Walking rates slow when pedestrian volumes increase and square footage per person decreases. Exhibit G.9 illustrates how average flow volumes decrease on walkways with increasing degrees of pedestrian density.

A spatial bubble is the preferred distance of unobstructed forward vision while walking under various circumstances. Exhibit G.10 illustrates the spatial bubbles that are comfortable for the average pedestrian while attending a public event, shopping, walking under normal conditions, and walking for pleasure. This information is helpful to the designer for use in calculating how much forward clear space is necessary to maintain a reasonable degree of comfort for pedestrians.

EXHIBIT G.7 ***Common Characteristics of Crashes Involving Pedestrians***

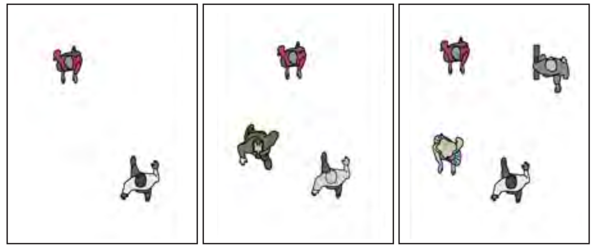
Driver inattention
Struck by a vehicle while crossing at an intersection (approximately 50 percent of all crashes nationwide)
Struck by vehicle while crossing mid-block (approximately 33 percent of all crashes nationwide)
Struck from behind while walking along the roadway in the same direction of traffic, particularly in rural areas *(Note: Hawaii Revised Statute 291C-76 (b) states: Where sidewalks are not provided, any pedestrian walking along and upon a highway shall, when practicable, walk only on the left side of the roadway or its shoulder facing traffic which may approach from the opposite direction.)*
Motorists exceeding safe speed (contributes to most pedestrian deaths)
Pedestrians darting out into the street at mid-block (a common type of pedestrian crash involving children)
Vehicles backing up (difficult to see children and others walking behind)
Crashes in urban areas (80 percent of all crashes nationwide)

EXHIBIT G.8 **Human Dimension When Walking**
(Adapted from Time-Saver Standards for Landscape Architecture)

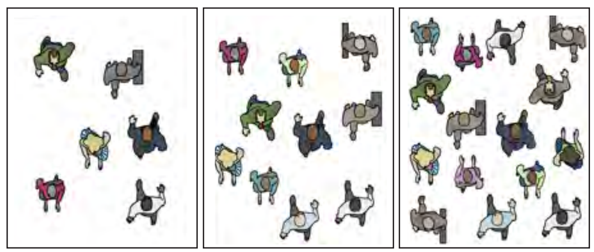


Sidewalks that are minimum six feet in width allow two pedestrians to walk comfortably side-by-side.

EXHIBIT G.9 **Spatial Needs for Pedestrians**
(Adapted from Time-Saver Standards for Landscape Architecture)



FV:	7 pfm	10 pfm	15 pfm
AS:	3 mph	2.8 mph	2.6 mph
O:	36 sf/p	25 sf/p	15 sf/p



FV:	20 pfm	25 pfm	> 25 pfm
AS:	2.3 mph	1.5 mph	0-1.25 mph
O:	10 sf/p	5 sf/p	< 5 sf/p

LEGEND

FV	flow volume
AS	average speed
O	occupancy
sf/p	square feet per person
pfm	pedestrian per foot width of walkway per minute

Older Adults as Pedestrians

Older adults have unique characteristics and special needs as pedestrians. As populations age, transit accessibility and safe walking routes become more important. Research shows that people over 60 walk more, yet in some cases may have impaired mobility.

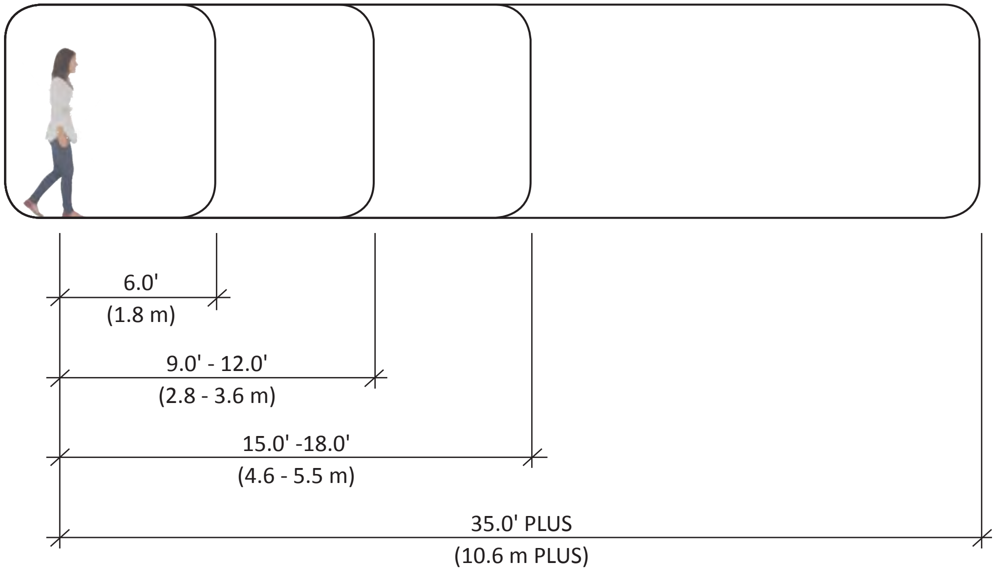
In Hawaii 13.3 percent of the population is represented by older adults (also referred to as elderly—people over 65 years). There are many locations in the islands where there are much higher levels of older adults, particularly in retirement communities and resorts (as high as 60 percent in some areas).

Older adults are more likely to be severely injured or killed when involved in a crash with a motor vehicle. Nationwide, people over age 65 represent approximately 13 percent of the population; yet account for 23 percent of all pedestrian deaths during that same year (*Walk Alert, National Pedestrian Safety Program Guide*). Another national statistic cites that pedestrians over 65 are two to four times more likely to die when involved in a pedestrian-motor vehicle collision. Older adults are particularly

Many older pedestrians rely on walking and transit as their primary modes of transportation.

The mild climate and the spectacular scenery of the Hawaiian Islands attracts more pedestrian activity than many other states.

EXHIBIT G.10 Spatial Bubbles *(Adapted from Time-Saver Standards for Landscape Architecture)*



more vulnerable while crossing the street, since they need more time to cross. Exhibit G.11 lists some typical elements that can aid older adult pedestrians in their travel.

Younger Pedestrians

Younger pedestrians (under 17 years old) are also important to consider because they do not drive (or if newly licensed, typically drive less than adults). Young pedestrians most often rely on safe walking routes to school and in some cases good pedestrian access to transit. The Hawaii statewide average for the population under 17 is 22.9 percent, with higher levels in this age group in various locations throughout the state (such as the central and western part of Oahu, with 20 to 60 percent under 17 years old).

Very young pedestrians also have particular needs. They tend to get distracted more easily and may wander into or dart out into traffic unexpectedly. Teens may have a false sense of security and safety in their quest to gain more independence.

COMMON CHARACTERISTICS BY AGE GROUP

AGE 0 TO 4	• *Learning to walk* • *Requiring constant parental supervision* • *Developing peripheral vision, depth perception*
AGE 5 TO 12	• *Increasing independence, but still requiring supervision* • *Poor depth perception* • *Susceptible to "dart out"/ intersection dash*
AGE 13 TO 18	• *Sense of invulnerability* • *Intersection dash*
AGE 19 TO 40	• *Active, fully aware of traffic environment*
AGE 41 TO 65	• *Slowing of reflexes*
AGE 65+	• *Street crossing difficulty* • *Poor vision* • *Difficulty hearing vehicles approaching from behind* • *High fatality rate*

EXHIBIT G.11 ***Aids to Older Pedestrians***

Reduced roadway crossing distances (bulb-outs and curb extensions)
Signals within 60 feet of viewing distance; easy-to-read signs
Refuge areas in roadway crossings
Traffic calming
Shelter and shade
Handrails
Smooth surfaces and unobstructed travel ways
Signal timing at lower than average walking speed

Design is only one aspect that can help in improving safety for younger pedestrians. Besides adult supervision, which is always important, educational programs geared toward increasing a child's awareness of traffic and safety measures are an important tool to increasing their safety as pedestrians. In addition to adult supervision and effective education programs, good design of the places children walk most, such as school zones and school walking routes, neighborhood streets, and parks, can significantly help to improve their safety.

Refer to Toolbox Section 8—Children and School Zones for more information.

People with Disabilities

People with disabilities, including those using special walking aids or wheelchairs, need carefully designed facilities that eliminate barriers.

The needs of pedestrians with disabilities can vary widely depending on the type of disability and level of impairment. Elements that are helpful to people with disabilities are listed in Exhibit G.12.

It is important to understand the characteristics of all pedestrian age groups in order to fully address their needs in design.

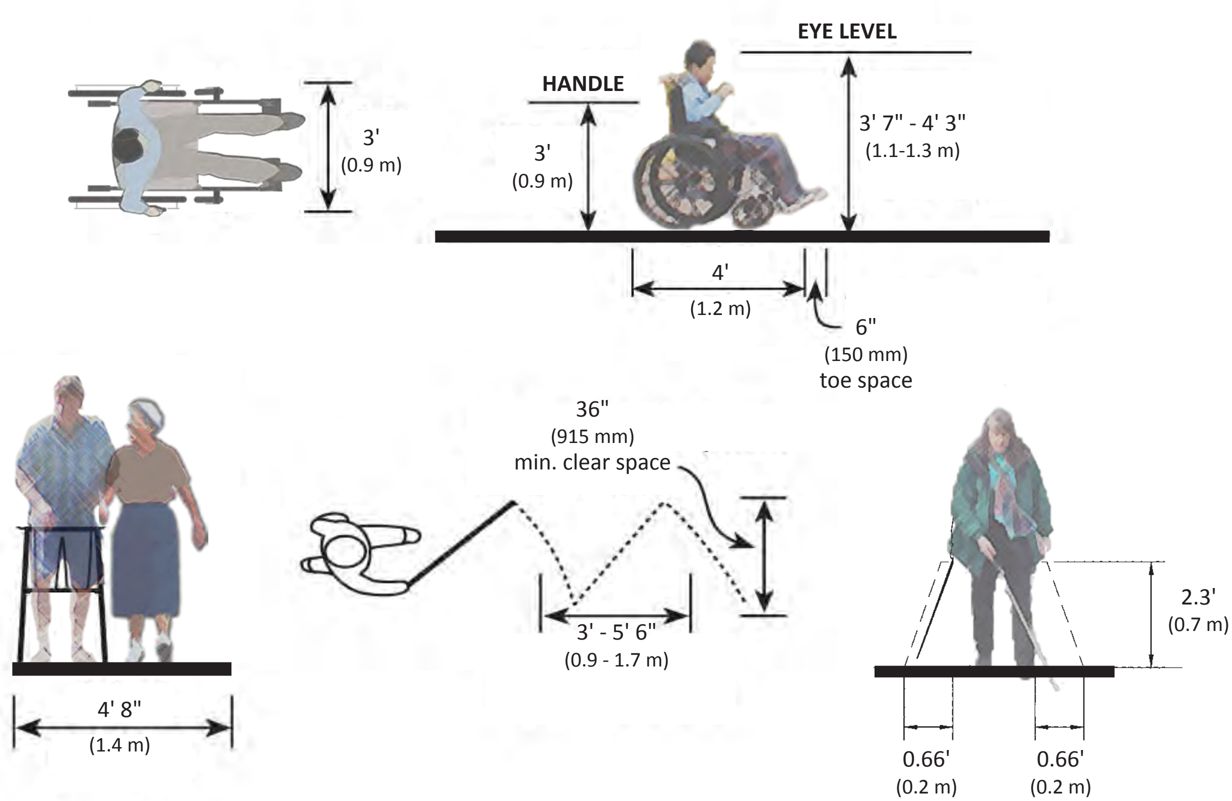
General Characteristics and Needs of Pedestrians

EXHIBIT G.12 Aids to Pedestrians with Disabilities

Curb cuts and ramps
Tactile warnings
Easy-to-reach activation buttons
Audible warnings and message systems
Raised and Braille letters for communication
Signal timing at lower than average walking speed
Maximum grade of 1:20 and cross slope of 1:50 (ramps can be 1:12)
Roadway crossings and refuges
Reduced roadway crossing distances (bulb-outs and curb extensions)
Traffic calming
Handrails
Smooth surfaces and unobstructed travel ways

Space requirements for pedestrians with disabilities vary considerably depending upon their physical abilities and the assistive devices they use. Spaces designed to accommodate wheelchair users are generally considered to be functional and advantageous for most people. Exhibit G.13 illustrates the spatial dimensions of a wheelchair user, a person on crutches, and a sight-impaired person. This exhibit illustrates why a minimum six-foot-wide space is needed for two wheelchair users to pass. For additional information related to designing facilities for people with disabilities, refer to Toolbox Section 3—Accessibility.

EXHIBIT G.13 Spatial Dimensions for People with Disabilities *(Source: Accessibility for All)*



HAWAII PEDESTRIAN TOOLBOX


Kids'

TOOLBOX SECTION 1

Thinking about Pedestrians from the Start—Creating Pedestrian-Friendly Communities

Pedestrian-friendly communities are often the most desirable places to live, work, and visit.

CREATING PEDESTRIAN-FRIENDLY COMMUNITIES

This first section of the Hawaii Pedestrian Toolbox provides an overview of important considerations related to planning and general design of facilities for pedestrians. Creating pedestrian-friendly communities is an important focus of this section, and addressing pedestrians' needs as part of every planning effort and project is encouraged. Best practices guidance that can be applied at a district, community, or regional level to improve conditions for pedestrians in Hawaii is provided.

Why Planning for Pedestrians is Important

Promoting Pedestrian Travel

Pedestrians are an important and integral part of Hawaii's transportation system and every transportation project, whether planning or design, should consider the needs of pedestrians from the start. This is consistent with the State's Complete Streets Policy, which requires consideration of all modes and users on all public highways, roadways, and streets statewide.

Research has shown that well planned, designed, and maintained pedestrian facilities encourage walking and promote higher levels of pedestrian travel. When pedestrian access is expanded and existing conditions for pedestrians are improved, higher numbers of pedestrians can be expected to use the system. This not only applies to development of new facilities, but also to improvement and retrofit of existing facilities for pedestrian use.

Pedestrians' needs should be considered as part of all planning and design projects.

IN THIS SECTION

Considering Pedestrians' Needs in Planning

The need for pedestrian facilities should be considered at the inception of all public and private projects, and projects should address pedestrian needs as part of the total transportation solution. Various types of planning activities where pedestrian needs should be evaluated and addressed include the following:

- Island-wide/county-wide and city-wide comprehensive plans and transportation plans
- Community development plans
- Specific area and neighborhood plans/ special district studies
- Corridor plans and studies
- Transportation network plans with pedestrian circulation as a critical element
- Transit access studies and intermodal facilities plans
- School walk route plans and safety plans
- Development-related transportation impact studies
- Project alternatives development

Planning for pedestrians from the onset, whether as part of a community-wide planning effort or a specific project allows potential conflicts between transportation modes related to safety and level of service to be resolved early on. This avoids problems associated with pedestrians being an afterthought.

Considering the Setting

The character and setting of the area, nearby land use densities, origins, and destinations can influence the level of pedestrian use. Consider the potential for increases in use that may occur when pedestrian facilities or pedestrian generating improvements (such as transit) are installed. Often, decisions not to install pedestrian facilities are short-sighted, based on the perception that an area with

Pedestrians are a fundamental part of the transportation system.

low pedestrian use doesn't need improvement. In reality, pedestrians are probably not using the system because it is not adequately meeting their needs under existing conditions. Sometimes land uses can change and facilities need to be upgraded to serve more intensive pedestrian travel. After conditions are improved for pedestrians and the level of walking increases, multiple benefits can be realized, including:

- Walking as a transportation mode can reduce reliance on motor vehicles and reduce the number of motor vehicle trips and total vehicle miles traveled.
- This in turn can reduce greenhouse gas emissions and other motor vehicle-related environmental impacts (such as traffic congestion, noise, and pollution).
- Pedestrian facilities connect people to transit and increased transit use also brings the benefits described above.
- Walking is healthy and can improve fitness and enhance the quality of life in the islands.
- The best and safest communities and the most desirable places to live, work, and visit are pedestrian-friendly.

General Description of Pedestrian Facilities

The types of facilities that serve pedestrians' needs include far more than just sidewalks. Pedestrian facilities include a wide array of improvements and treatments, such as:

- Sidewalks, walkways, and other pedestrian facilities within the right-of-way
- Paths and trails outside the right-of-way
- Facilities on sites (including pedestrian spaces around buildings and through parking areas)
- Intersections and traffic control, including crosswalks, pedestrian signals and actuation, signs, etc.
- Curb ramps
- Mid-block crossing treatments
- Curb extensions (bulb outs) and median refuge islands, which reduce the crossing width for pedestrians
- Grade separations (such as underpasses and overpasses)
- Wide, delineated shoulders (although not

Pedestrians enjoying a walk in Hanalei, Kauai

Pedestrian facilities connect people to and from transit.

Pedestrian crossing the Mamalahoa Highway on the Big Island

Pedestrians strolling along the water in Honolulu

designed as pedestrian facilities, these may be used by pedestrians, particularly in rural areas). See more discussion about shoulders in Toolbox Section 2.

- Transit waiting areas, shelters, and amenities
- Streetscape furnishings and elements that create a safe, inviting pedestrian-friendly atmosphere (such as benches, landscaping, pedestrian-oriented lighting, public art, etc.)
- Other technology, design features, and strategies intended to encourage and enhance pedestrian travel (such as traffic calming features, speed limit warning signs, and other devices)

Developing Pedestrian Plans

The Statewide Pedestrian Master Plan has been developed for Hawaii, and this toolbox is a companion document to the master plan. Additional pedestrian plans or master plans can be developed at the island-wide, community-wide, city-wide, county-wide, neighborhood, or resort scale. Pedestrian plans provide opportunities to assess and focus on local needs. These plans can be created independently from other plans or as an integral part of comprehensive plans or transportation plans being developed. Common elements found in pedestrian plans include the following.

- Policy framework: vision, goals, policies, and actions
- Interdepartmental coordination within agencies and jurisdictions, as well as coordination between agencies and jurisdictions
- Collection and analysis of pedestrian crash data, including high crash/accident locations
- Pedestrian design criteria (tailored to local context and needs)
- Assessment of Americans with Disabilities Act (ADA) compliance and accessibility design guidelines
- Pedestrian and transportation improvement projects, defined and prioritized
- Funding, phased to match prioritized needs
- Recommendations and funding for education and safety programs
- Public involvement and community outreach

Effective Education, Enforcement, Encouragement, Evaluation, and Equity Programs

Good planning and design are important factors in incorporating pedestrians into Hawaii's transportation system. But good planning and design can't be expected to solve all pedestrian-related problems. Effective education, enforcement, encouragement, evaluation, and equity programs are other important tools that heighten awareness of pedestrians and their needs. Community equity in improving the pedestrian environment is important. The diverse needs of all pedestrians must be addressed—this includes pedestrians of all ages, abilities, ethnicities, races, religions, economic levels, or other cultural characteristics.

For pedestrian travel to be effective, efficient, and safe, motorists and pedestrians must follow important traffic rules and laws. Breaking these rules and laws puts pedestrians and other roadway users at risk and is inconsistent with the Statewide Pedestrian Master Plan's objective to enhance the quality of the pedestrian environment, increase pedestrian activity levels, and improve safety. Efforts must continue to encourage a culture of respect and shared use among motorists and pedestrians alike.

Best practices related to education, enforcement, encouragement, and evaluation programs are provided in Toolbox Section 10.

Citizens Advisory Committee working together on the Statewide Pedestrian Master Plan.

The "Bigger Picture"—Creating Pedestrian-Friendly Communities

There are many good sources of information about how to plan and design pedestrian-friendly communities, as listed at the end of this toolbox section. Common characteristics of pedestrian-friendly communities are listed in Exhibit 1.1.

Context-Based Planning

Context-based planning has become a best practice across America. Development of context sensitive solutions is strongly encouraged by the Hawaii Department of Transportation, the Federal Highway

Administration, and other local, state, and federal agencies. The principles of context sensitive solutions promote a collaborative, interdisciplinary process that involves all stakeholders in planning and design. For pedestrians, context-based planning focuses on improving the environment for pedestrians based on the surrounding context—land uses, the transportation network, environmental characteristics, and other factors. Context-based planning is often the first step to creating or enhancing a walkable community.

The Rural to Urban Transect (Exhibit 1.2) on page 1-8, often referenced by urban planners and designers, shows various context zones and the types of transportation facilities that generally exist in these zones. In context zones that are more urban, there are typically greater and more diverse transportation facilities and pedestrian networks and a greater intensity of street networks. This diagram is a generalization. Contexts can vary widely, and in Hawaii there are many rural villages, town centers, resorts and recreational areas with pedestrian needs that are just as important as those in urban areas.

EXHIBIT 1.1 ***Common Characteristics of Pedestrian-Friendly Communities***

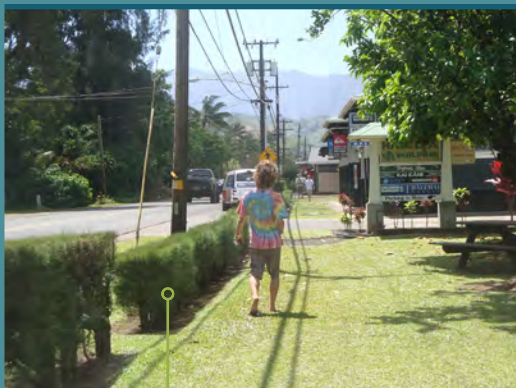
Pedestrians are an Integral Part of the Transportation System	Pedestrians' needs are considered from the start in all planning and design projects, whether private or public, and pedestrian travel is viewed as a fundamental component of the transportation system and the pedestrian mode is closely coordinated with other modes. All streets are designed with pedestrians' needs in mind.
Policy-making Supports Pedestrians	Proactive statewide, regional, and local policy development sets the stage for establishing a stronger focus on pedestrian issues and encouraging communities to better meet pedestrian needs.
Close Coordination between Jurisdictions	Close coordination between jurisdictions results in seamless connections between communities and a sufficient level of pedestrian facilities in place to meet current and future needs.
Pedestrian-oriented Land Uses and Pedestrian-supportive Land Use Patterns	Land uses attract and accommodate pedestrian activity. Land use patterns, such as grid street networks, shorter blocks, and compact "village-oriented" mixed use development of adequate density enhance pedestrian mobility.
Linkages to a Variety of Land Uses/ Regional Connectivity	Pedestrian circulation and access is provided to shopping malls, transit, downtown, schools, parks, offices, mixed-use developments, and other community origins and destinations, as well as other communities within the region.
Continuous Systems/ Connectivity	A complete system of interconnected streets, pedestrian walkways, and other pedestrian facilities is provided to increase pedestrian travel.
Shortened-Trips and Convenient Access	Connections are provided between popular origins and destinations, between dead-end streets or cul-de-sacs, or as shortcuts through open spaces.
Continuous Separation from Traffic	Buffers from motor vehicles and separation of uses are provided.
Designated Space	Pedestrian facilities are well delineated, signed, and marked.
Security and Visibility	Planning and design to ensure a secure environment for pedestrians is important. Lighting, increased visibility, open sight-lines, access to police and emergency vehicles, and locating pedestrian facilities adjacent to neighborhoods and businesses can increase safety. Pedestrian activity during all hours of the day enhances security.
Reduced Conflicts between Pedestrians and Traffic	Driveway crossings are minimized and well defined. Street crossings are reduced in width as much as possible and pedestrian refuge areas are provided.

EXHIBIT 1.1 ***Common Characteristics of Pedestrian-Friendly Communities, Continued***

Reduced Speeds and Traffic Calming	High speed vehicle travel is discouraged either by original design or retrofitted traffic calming measures. Neighborhood traffic calming methods are provided such as trees, traffic circles, curb extensions (bulbs), neck-downs, and other techniques to lower vehicle speeds and create safer conditions for pedestrians.
Parking Supply and Location	Parking supply is reduced or managed using methods that encourage walking. Parking is screened from pedestrian areas. Pedestrians have direct access from parking to buildings and other destinations. On-street parking provides a buffer between roadway/street travel lanes and the pedestrian travel zone.
Accessible and Appropriately Located Transit	Siting of transit facilities adjacent to work, residential areas, shopping, and recreational facilities is provided to encourage pedestrian trips. Transit stops and centers are conveniently located. Adequate pedestrian facilities to access transit are provided, which is essential to their success as alternative modes of travel.
Lively Public Spaces	Secure, attractive, and active spaces provide focal points in the community where people can gather and interact. Pedestrian pocket parks and plazas are examples.
Character	Character attractive to pedestrians is preserved or created. Design is focused on human scale. Preservation of important cultural, historic, and architectural resources strengthens community heritage and character. Streetscape enhancements and public art also enhance character.
Scenic Opportunities	Attractive environments and scenic views, which encourage pedestrian use, particularly when facilities are oriented toward them, are provided.
Pedestrian Furnishings	Furnishings, such as benches, restrooms, drinking fountains, artwork, wayfinding signage, and other elements create a coherent, attractive, and functional environment for pedestrians.
Street Trees and Landscaping	Street trees are provided, bringing human scale to the street environment. Trees, landscaping, flowers in planting strips, containers, and other areas soften surrounding hard edges of buildings and parking lots, and add shade, life, color, and texture to the pedestrian's field of vision. Adding green to the urban environment also cools ambient temperatures, reducing the heat island effect.
Design Requirements	Guidelines and adopted standards are followed and, if deviated from, justified and documented.
Well-functioning Facilities	Adequate width and sight distance, accessible grades, and alignment to avoid blind corners are provided. Common problems, such as poor drainage, are avoided.
Proper Maintenance	Frequent cleanup and repair on a regular basis ensures ongoing, consistent use. High quality design and materials can minimize this need.

CONTEXT SENSITIVE SOLUTIONS

- ***Meet the needs of communities and stakeholders – the users of the system/facility;***
- ***Are compatible with their setting and preserve scenic, aesthetic, historic and environmental resources;***
- ***Respect design objectives for safety, efficiency, multi-modal mobility, capacity, and maintenance; and***
- ***Integrate community objectives and values related to compatibility, livability, equity, sense of place, urban design, cost, and other environmental considerations.***



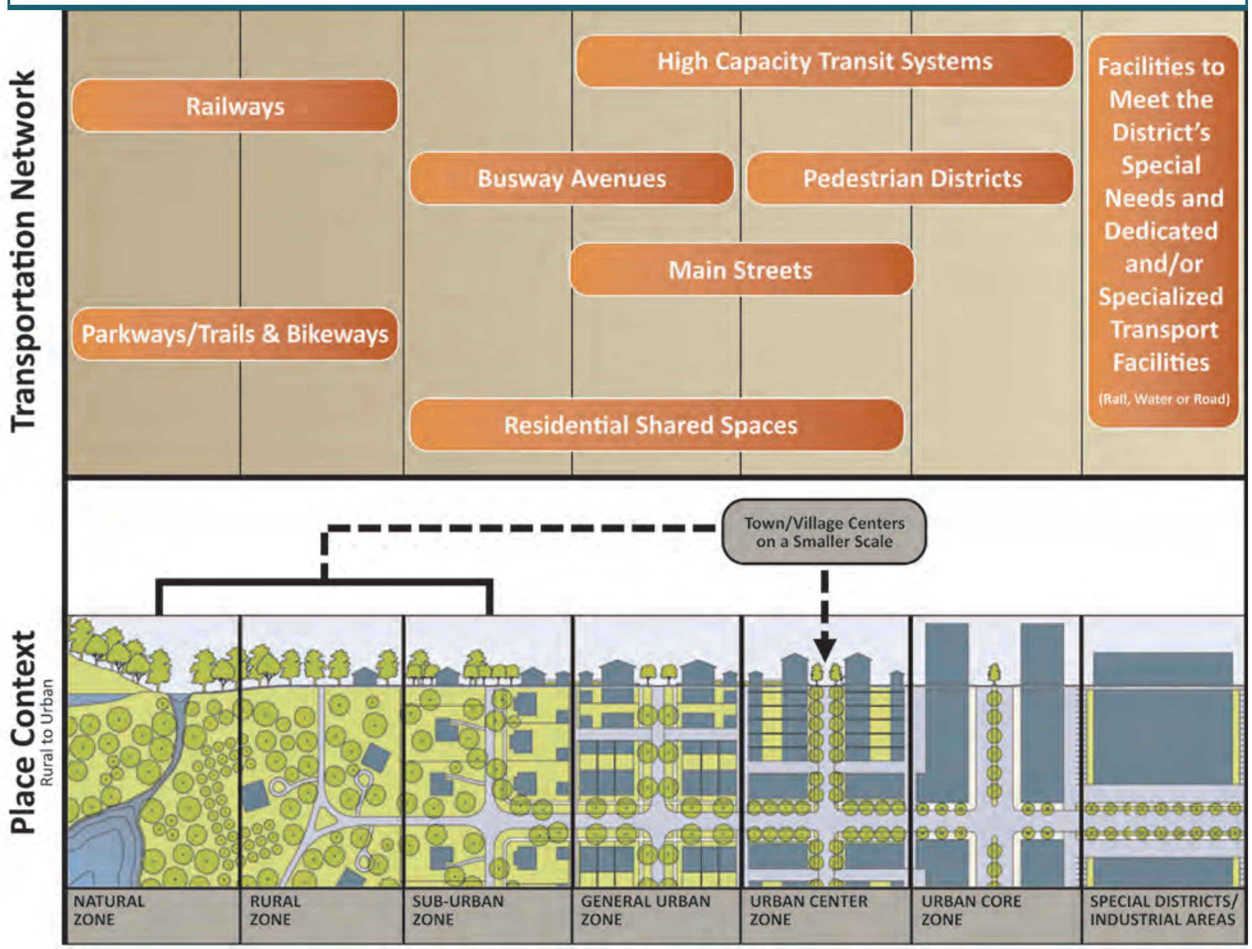
Pedestrian on Kauai

Pedestrians enjoy walking in areas that are designed with the human scale in mind.

Connectivity

Pedestrians want facilities that are continuous, well-connected, safe, attractive, convenient, and easy to use. If designed properly, the best public pedestrian facilities will also be the most durable and the easiest to maintain. Poor design of pedestrian facilities can lead to perpetual problems and actually discourage

EXHIBIT 1.2 Context-Based Planning—Rural to Urban Transect

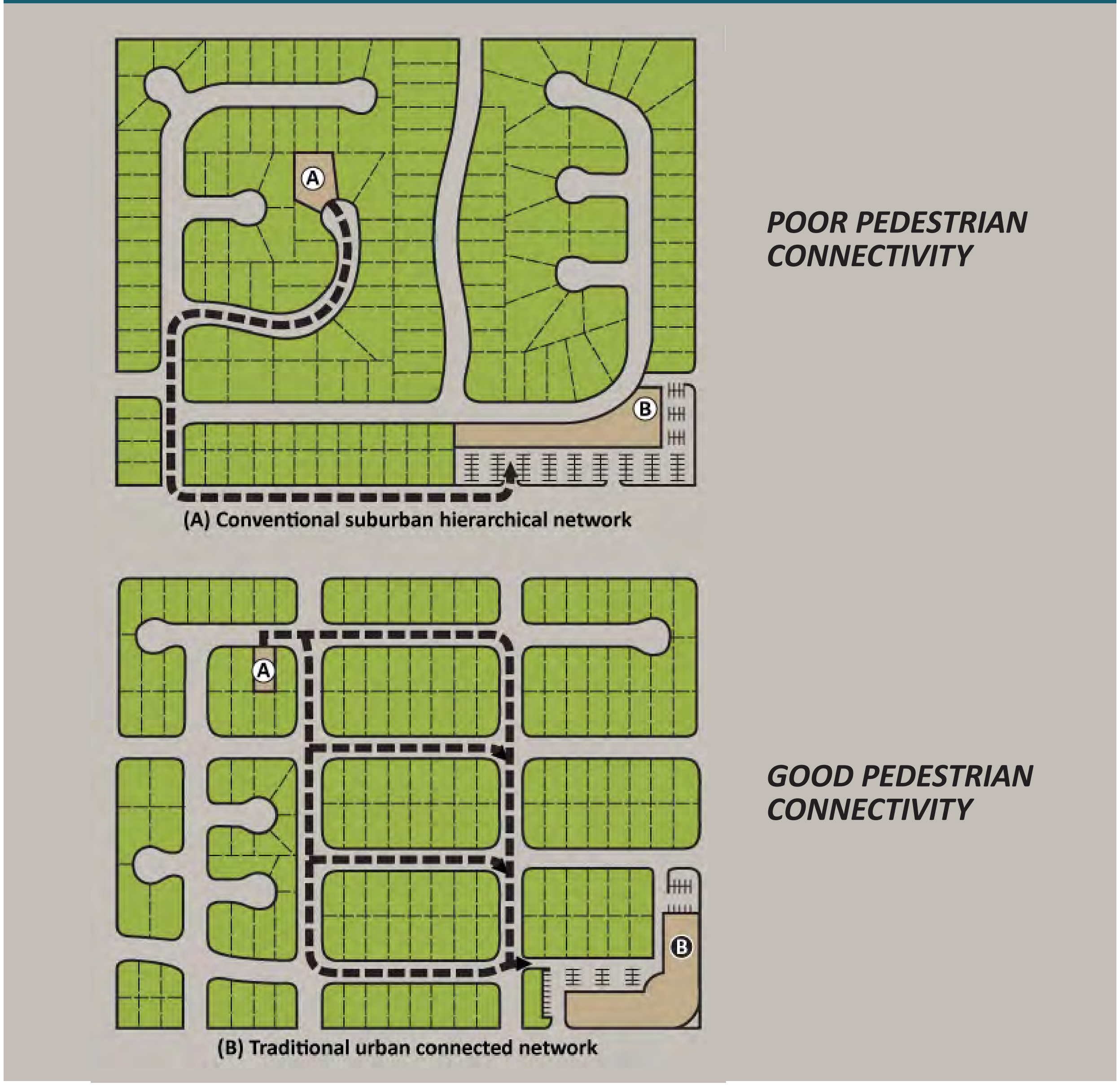


Adapted from matrix by Smart Code v. 9.2 (smartcodecentral.com) and Lawrence Aurbach, "Towards a Functional Classification Replacement" use if pedestrians are not well connected in the transportation system. Inadequate, disconnected, unattractive, and poorly designed and maintained facilities can be viewed as a waste of money and resources and a hindrance to community vitality.

Connectivity is often cited as a measure of livable and walkable communities. Typically, the more connected a community or setting is, the more walkable it is. Connectivity is represented by the level of links and nodes of a transportation network that are interconnected in a grid-like and/or web-like pattern. For pedestrians, this translates to an interconnected system of sidewalks, walkways, paths, and other facilities, as well as intersection and crossing improvements. Higher connectivity allows pedestrians to travel more easily to and from various points in the community. It also offers a higher degree of route choice to pedestrians, encouraging them to walk more. Good connectivity benefits all modes of transportation, not just pedestrians.

Conventional development patterns often resulted in networks of widely spaced arterial roads and large blocks with limited to poor

EXHIBIT 1.3 Connectivity Examples



Adapted from Designing Walkable Urban Thoroughfares, ITE, 2010; Original Source: Kimley-Horn and Associates and Digital Media Productions.

EXHIBIT 1.4 Measuring Network Connectivity and Accessibility for Walkability

Connectivity can be measured in various ways. Planning, design, and engineering practitioners have developed a variety of indices for network connectivity and accessibility:

Links and nodes (index): Roadway (or modal) links or segments divided by the number of nodes (intersections). Ranges from 1.0 (poorest level; all cul-de-sacs) to 2.5 (full grid). Minimum index for a walkable community is 1.4 to 1.6.

Intersection ratio: The ratio of intersections divided by intersections and dead ends, expressed on a scale from 0.0 to 1.0 (US EPA 2002). An index of more than 0.75 is desirable.

Average intersection spacing and block length: For walkability, a maximum distance of 660 feet; with desirable spacing at less than 400 feet. Block length in urban centers and village cores should ideally not exceed 400 feet and preferably be 200 to 300 feet to support pedestrian activity.

Intersection density: The number of surface street intersections in a given area, such as a square mile. The more intersections, the greater degree of connectivity.

Blocks per square mile: For walkability this index should be at least 100.

Directness (index): Actual travel distance divided by direct travel distance. Ideal index is 1.0. For walkability, this index should be 1.5 or less.

Adapted from: Texas Transportation Institute, Donohue, Nick, "Secondary Street Acceptance Requirements," Office of the Secretary of Transportation, Commonwealth of Virginia, 2008. "Smart Growth Index Model," US EPA 2002

connectivity, particularly in communities, suburban areas, and neighborhoods developed between the 1950s and the 1990s. Exhibit 1.3 illustrates a conventional suburban hierarchical network compared to a more connected network. Many well-connected grid and web networks developed throughout the US in the 1800s and early 1900s are common in urban and town centers. Neo-traditional and new urbanism planning practices often focus on returning to well-connected networks as a key component of livable, walkable communities. Planners can measure connectivity in a number of ways. See Exhibit 1.4.

Shared use path on Kauai

Creating a Continuous Pedestrian System

The pedestrian transportation system in Hawaii should be consistent across jurisdictional boundaries and public and private developments. Regional and local pedestrian systems need to be planned, designed, and constructed to provide a comprehensive network of travel options for pedestrians.

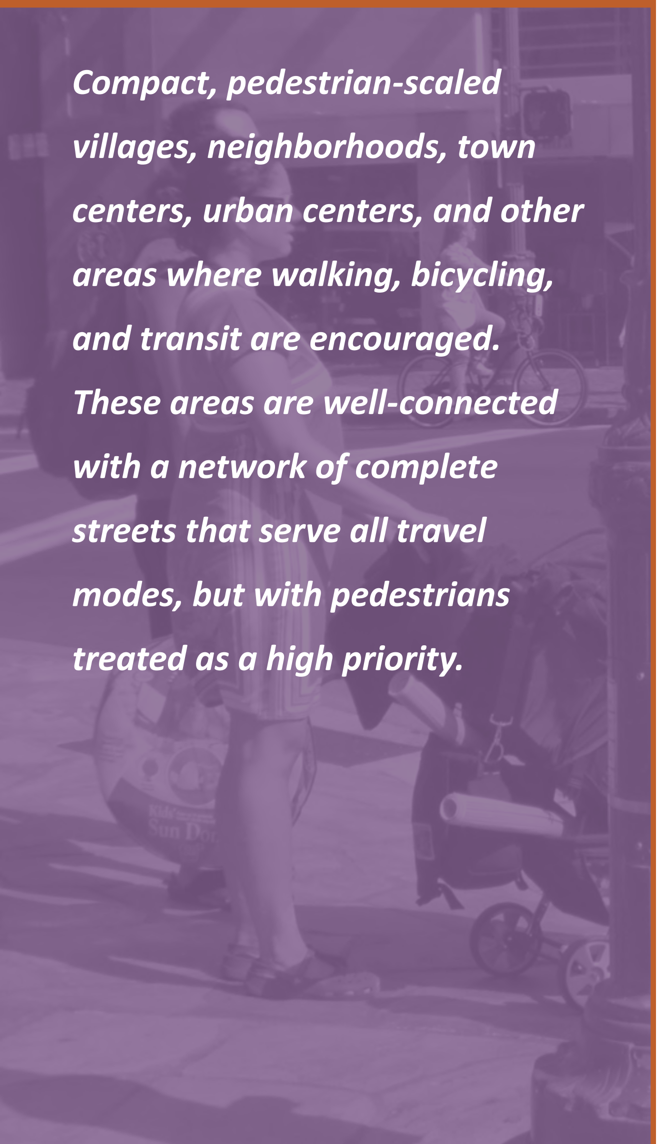
The guidelines throughout this toolbox encourage more consistent planning and design of pedestrian facilities throughout the state, and the responsibility to develop and support a seamless pedestrian transportation network lies with everyone, including the public- and private-sector.

Under current state law, local jurisdictions have the authority to require property owners and developers to provide safe pedestrian accommodations such as sidewalks, paths, or other means of access.

Targeting public funding so that strategically located projects can be designed and built to fill in the gaps between private development is one way to help improve the overall system.

All of us are pedestrians at some point in the day.

WALKABLE COMMUNITIES



Compact, pedestrian-scaled villages, neighborhoods, town centers, urban centers, and other areas where walking, bicycling, and transit are encouraged. These areas are well-connected with a network of complete streets that serve all travel modes, but with pedestrians treated as a high priority.

Retrofit of existing areas where pedestrian facilities are not accessible is another important step. The development of a seamless pedestrian system will be the result of both public and private investment throughout communities and neighborhoods.

Coordination between agencies, governments, and private entities is critical to the success of regional pedestrian systems. School districts, utility companies, private corporations, and local agencies need to work together at the onset of transportation and development projects to reach the best solutions for all interests involved.

Considering the needs of pedestrians throughout project planning, design, and development processes at all levels will increase pedestrian safety and mobility and improve the pedestrian network overall.

Analyzing Walkability

In addition to the use of a context-based planning analysis and connectivity indices described above, there are various types of tools and techniques available for measuring walkability.

Walk Score

Various online resources and computer programs have been developed to assist walkability analysis. One example, Walk Score, is a free, user-friendly program that can be used online to measure walkability of many locations. Walk Score measures the walkability of places based on walking distance and pedestrian connectivity. Each location is given a score from 0 to 100. The most walkable places score from 90 to 100 (Walker's Paradise) and the least walkable places score from 0 to 24 (Car-Dependent). Visit ***www.walkscore.com*** for more information.

Walkability Audits

A walkability audit is an unbiased evaluation of the pedestrian environment to identify concerns for pedestrians related to safety, access, comfort, and convenience. In addition to identifying problems, audits can be used to identify potential solutions (such as engineering treatments, policy changes, or education and enforcement measures). Walkability audits can be geared toward examining one or many specific types of facilities (crosswalks, intersections, bus stops, school zones, sidewalks, etc.). Audits can be performed at many

HOW WALK SCORE WORKS

Walk Score is a number between 0 and 100 that measures the walkability of any address. You type in the address and characteristics of the place you want to measure and the program outputs a score.

WALK SCORE	DESCRIPTION
90–100	**Walker's Paradise** — Daily errands do not require a car.
70–89	**Very Walkable** — Most errands can be accomplished on foot.
50–69	**Somewhat Walkable** — Some amenities within walking distance.
25–49	**Car-Dependent** — A few amenities within walking distance.
0–24	**Car-Dependent** — Almost all errands require a car.

different stages of the walking environment's development, including planning and design, during construction, and for completed or established facilities.

Informal audits can be performed by any individual or community group. More formal audits (e.g., those that follow a standardized set of audit procedures) are often performed by a multidisciplinary team of trained professionals, including engineers, planners, transportation researchers, pedestrian and bicycle specialists, and/or others. Audits are typically performed by a person or group that is independent of the person or agency responsible for the design, development, or maintenance of the facility audited. This is to ensure that the audit is conducted with "fresh eyes" and that the results of the audit are unbiased. It also helps prevent potential conflicts of interest. If a review/evaluation of a facility is conducted by the same group responsible for it, this process is an assessment—there is value to having an assessment, but it is not the same as an audit. Walkinginfo.org provides links to various types of walkability audits. ***http://www.walkinginfo.org/problems/audits.cfm*** (May 2013).

WALKING DISTANCES

For planning purposes, it is common practice to apply the following distances in analyzing walkability.

DISTANCE		TIME	TO/FROM AND OTHER CONSIDERATIONS
¼ mi	400 m	5 min	Major activity centers, campuses, urban hubs, and other key destinations (including those listed below with the ½ mile distance); this is the most common metric used in walkability and pedshed analyses
½ mi	800 m	10 min	Neighborhood scale, shopping areas, parks, schools, transit stations, bus stops, community centers, recreation areas
1 mi	1600 m	20 min	People often walk further in nice weather and for recreational purposes, particularly when well-connected, complete pedestrian networks are available

HOW FAR WILL PEOPLE WALK?

The distance people are willing to walk can vary greatly depending on context, obstacles to pedestrian travel, safety, security, convenience, directness, attractiveness of the route and other factors. Ongoing research provides important information about how far people will walk and how distance choice is influenced by various factors. A study completed in 2007 suggests the distance people will walk to transit may be less a function of length than of the obstacles they find along the way. Major findings of the study, indicate:

- *Pedestrians say their primary concern in choosing a route is minimizing time and distance.*
- *Secondary factors influencing route choice (but still indicated as influencing factors) are safety, attractiveness of the route, sidewalk quality, and the absence of long waits at traffic lights.*
- *Pedestrian walk farther to access light rail stations than previously assumed (a mean distance of about a half mile rather than the common assumption of a quarter to a third of a mile).*

The US Department of Health and Human Services Centers for Disease Control and Prevention offers a downloadable ***Walkability Audit Tool*** that can be used to measure walkability in communities or neighborhoods.

Examples of Connectivity and Walkability

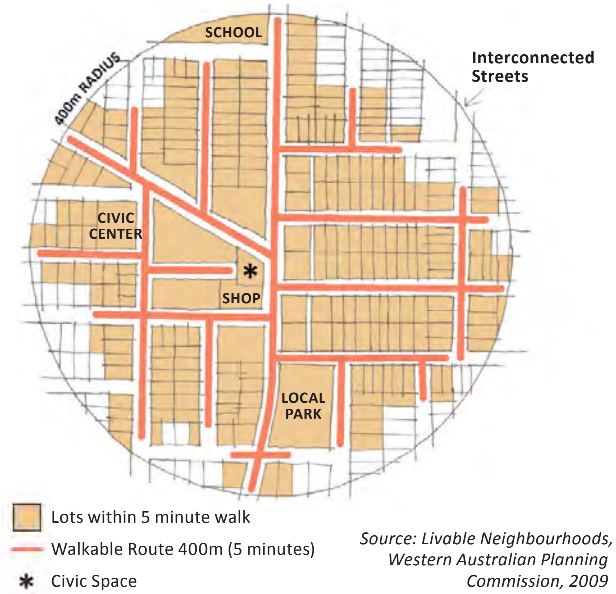
Aerial photos are provided for several locations on the pages 1-16 and 1-17, and the Walk Score rating for each is indicated. The most walkable places tend to be those with a well-connected grid with sidewalks and pedestrian facilities, as well as walking-distance access between destinations. The least walkable places tend to have barriers to connectivity, incomplete pedestrian facilities, and longer walking distances between destinations.

GIS and Pedshed Analysis

Exhibit 1.5 illustrates typical pedshed analyses at a neighborhood and district scale. The use of geographic information systems (GIS) mapping and planning technologies can greatly aide analysis of walkability in specific geographic areas at various scales (statewide, regional, local). A Pedshed Analysis is a specific

EXHIBIT 1.5 Pedshed Analysis Examples

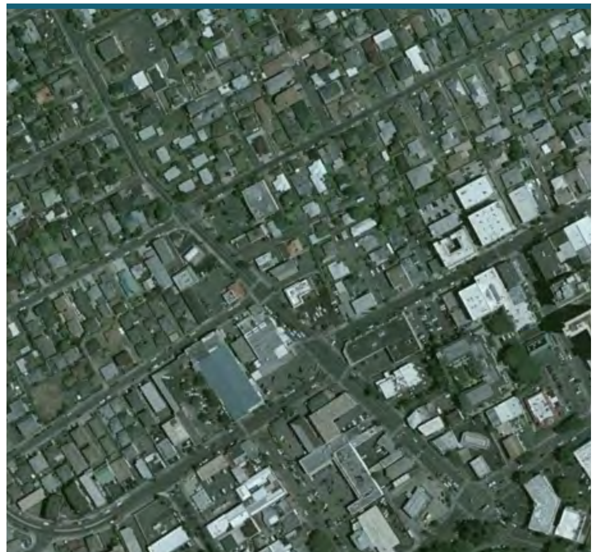
Source: Tsix Urbanists, Inc.



Source: Livable Neighbourhoods, Western Australian Planning Commission, 2009

Pedestrian-friendly public places often serve a healthy and diverse population of all ages, cultures, and interests.

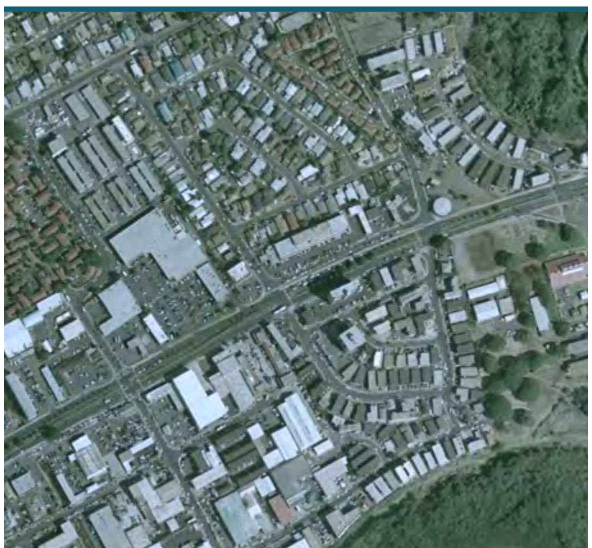
Kaimuki - Honolulu, HI (Oahu) **WALK SCORE 66**



Kailua, HI (Oahu) **WALK SCORE 44**

Lahaina, HI (Maui) **WALK SCORE 86**

Connectivity Examples–Hawaiian Islands



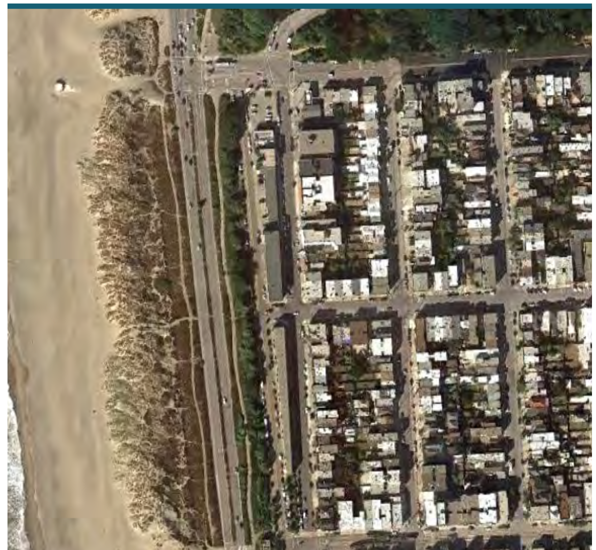
Waipahu, HI (Oahu) **WALK SCORE 57**

Waikiki - Honolulu, HI (Oahu) **WALK SCORE 74**

Hilo, HI (Big Island) **WALK SCORE 30**

See page 1-12 for more information about Walk Score
Source for aerial photos: Google Earth

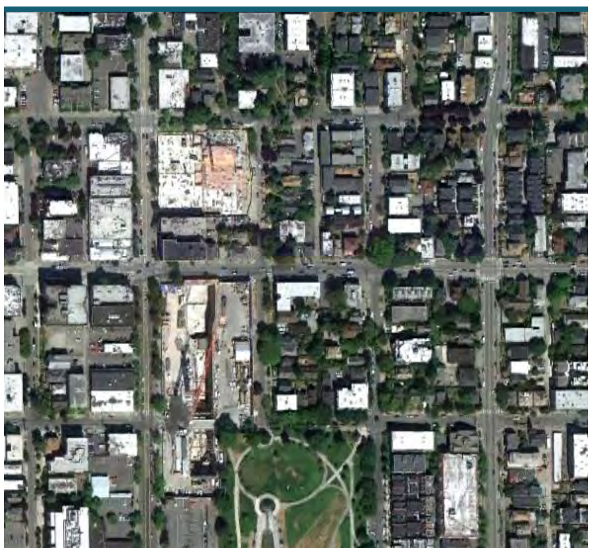
Little Havana - Miami, FL **WALK SCORE 82**



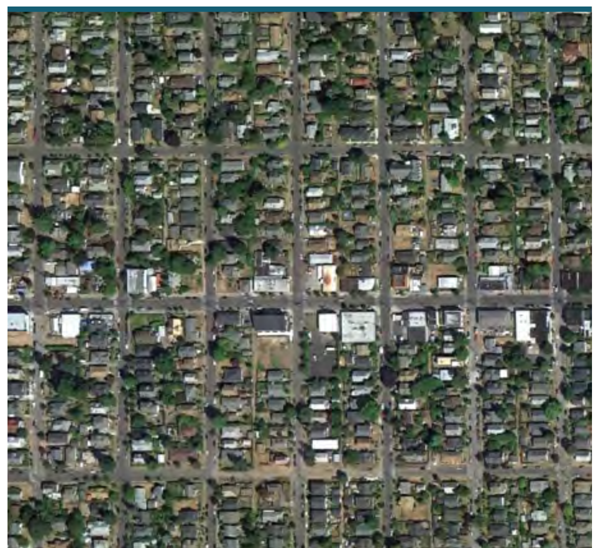
Outer Sunset - San Francisco, CA **WALK SCORE 74**

Wicker Park - Chicago, IL **WALK SCORE 91**

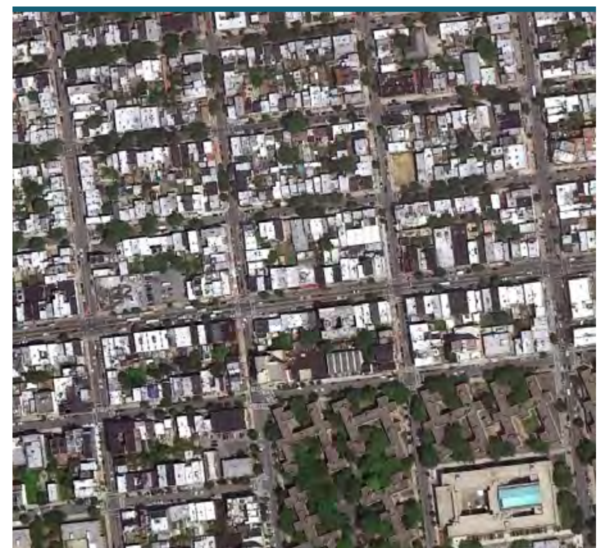
Connectivity Examples–Other Places in the United States



Capitol Hill - Seattle, WA **WALK SCORE 98**



Alberta District - Portland, OR **WALK SCORE 83**



Williamsburg - Brooklyn, NY **WALK SCORE 93**

See page 1-12 for more information about Walk Score
Source for aerial photos: Google Earth

approach that looks at the walking environment surrounding and between various origins and destinations. A specific center of activity is defined and then the walking routes (existing and proposed) to and from that center are mapped and analyzed. The walkable catchment area shown surrounding the center of activity is the resulting "pedshed." A five- to ten- minute walking distance to/from major destinations (quarter mile to half mile) is often used to define the pedshed.

Creating an Effective Pedestrian System

Pedestrian systems and facilities need to be functional and effectively used by pedestrians. Pedestrian facilities both encourage people to walk and improve pedestrian safety. The facilities must be well-designed and maintained to be effective. In communities, neighborhoods, and districts, there are a number of elements that contribute to an effective pedestrians system, such as:

- Widened, delineated paved shoulders to allow safer travel for pedestrians
- Sidewalks, paths, or walkways that are of sufficient width, clear of obstructions, and separated from traffic lanes
- Proper design and operation of traffic and pedestrian signals, including placement of pedestrian push buttons, where appropriate
- Planting buffers, raised curbs or other treatments that physically separate pedestrians from motor vehicle traffic at selected locations
- Facilities for persons with disabilities, including curb ramps, audible pedestrian signals, and longer intervals for slower pedestrian walking speeds
- Signing and marking, including pavement edgelines and pedestrian warning signs where needed

In some cases, an effective pedestrian system may include grade separated pedestrian crossings. But these must be clearly justified and carefully implemented, since such facilities may go unused or create illegal street crossing behavior by pedestrians if not properly planned, designed, and located. The best practice is to work to make the street level environment as complete, safe, and accessible for pedestrians as possible. Pedestrian exclusive areas, such as pedestrian malls may also be provided, but these also must be well-planned with respect to commercial development, traffic circulation, and visual appeal to be effective. See Toolbox Section 9—Special Pedestrian Districts and Site Design for Pedestrians for more specific design guidelines related to site development.

Exhibit 1.6 on page 1-19 provides guidance for designing effective pedestrian facilities.

Pedestrian-Oriented Development

Pedestrian-oriented development is typically accomplished through a mix of public policy, land use policy, and specific design practices including compact development, mixed-use, traffic calming, pedestrian- and public transit-orientation, and a mix of housing types. While pedestrian-oriented development works well in community centers and downtowns, it also can be applied successfully in rural and suburban areas. Pedestrian- and transit-oriented

EXHIBIT 1.6 *Creating an Effective Pedestrian System*

KEY

1. Locate parking near the buildings they serve, but avoid placing parking lots on all sides of buildings. These are difficult areas for pedestrians to cross through. Locating parking lots to the rear of buildings is a preferred best practice. Provide sidewalks directly adjacent to buildings along street frontages for easy direct access. On-street parking can serve as a buffer between cars and pedestrians.

2. Drop-off zones are most convenient when located as close to the primary entrance to the building as possible. Provide accessible passenger loading zones. Walkways should be unobstructed. Access to drop-off areas, parking, and building entries should be direct and convenient.

3. Provide site entrances that are visually well-defined and conveniently located in relation to the site and the building.

4. Use clear and easy to read signage and wayfinding elements to direct pedestrians to their origins and destinations.

5. Provide building entries that are clearly identified and accessible. Locate public facilities (restrooms, phones, drinking fountains) near entryways and accessible routes.

6. Locate transit waiting areas within 300 ft (90 m) of building entries for direct access. Overhead shelters or awnings next to buildings provide protection from weather. Provide adequate seating and lighting.

7. Provide resting areas where pedestrians must walk long distances. Benches and other furnishings should not encroach on walkways.

8. Provide walkways along clear and direct routes throughout sites. Surfaces should be firm, stable, and slip resistant. Accessible curb ramps shall be provided where necessary. Accessible walkways shall be continuous (not dead-ends).

9. Locate transit stops in highly visible and convenient areas along the street. Provide streetside pedestrian shelters and transparent wind screens at busy transit stops where awnings and other weather protections are not available.

development can improve quality of life by reducing traffic congestion and air pollution. It can also result in less loss of open space (with compact development) and reduced road construction and maintenance costs (with more uses located within walking distance). By incorporating accessible facilities and pedestrian-oriented development principles, new developments will achieve the following benefits.

Environmental Health

The level of vehicle miles traveled across the United States has increased three times as fast as the population over the last 30 years. This increase in auto-dependency has created adverse environmental impacts such as air and water pollution, which in turn affect environmental and human health. Land use practices that increase opportunities for pedestrian- and transit-oriented transportation help to reduce these adverse effects.

Human Health

The way our communities are planned and designed plays a critical role in our ability and willingness to engage in regular physical activity required for a healthy lifestyle. According to the United States Center for Disease Control and Prevention, "moderate physical activity performed on most days of the week can substantially reduce the risk of dying from heart disease, the leading cause of death in the United States, and can reduce the risk of developing colon cancer, diabetes, and high blood pressure." Currently, more than 60 percent of American adults are not regularly active, and 25 percent of the adult population is not active at all. Pedestrian-oriented development provides safe, accessible opportunities for integrating physical activity into our lives. For example, sidewalks create safe environments for children to walk to school, and paths located in and near neighborhoods encourage more walking and jogging.

Social Health

Compact villages and mixed use areas promote social interaction and a healthy economy by combining accessibility, networking, convenience, and creativity into daily routines. Alternative modes of transportation such as walking, biking, and public transit often provide more opportunities for social interaction than personal automobile use. Additionally, these alternative transportation modes allow us to be more aware and appreciate the environment around us, including our community's natural areas and resources. This combination of increased social opportunities and appreciation for our surroundings can often encourage people to become more involved in their communities.

Economic Health

Communities that implement pedestrian-oriented development practices experience less traffic noise, lower traffic speeds and vehicle-generated air pollution than other modern communities, are likely to generate higher property values. Studies show increasing rates of homeowners and businesses choosing to locate in areas with high livability and walkability, as well as walkable community centers. This activity in turn supports local, regional, and state economies.

Additional guidance related to pedestrian-oriented design and pedestrian-oriented districts is provided in Toolbox Section 9.

Pedestrian-Friendly Streets

Design of pedestrian-friendly streets is strongly encouraged by local and regional jurisdictions seeking to enhance the quality of life and safety of citizens in their communities. The meaning of “pedestrian-friendly” can be interpreted in many ways, but generally, the intent is for street design to incorporate elements that enhance the safety, security, comfort, and mobility of pedestrians. Refer to Toolbox Section 2 for specific guidance related to design of pedestrian-friendly streets.

Rural and Natural Areas

The beautiful, natural environment is one of the characteristics that inspires people to visit and live in the Hawaiian Islands. There are many natural and rural areas across the islands, and while pedestrian travel in these areas may be more limited than in urban and suburban areas, it does occur. For example, beach-goers and surfers sometimes need to cross rural highways when parking areas are located on one side and key destinations (such as resorts or beaches) on the other side. Pedestrians of all ages and capabilities use highways, roadways, and streets in rural and undeveloped areas across the state. Although people are walking in these areas, many existing streets, roadways, and highways do not adequately support their needs.

Highways as “Main Streets”

When rural highways enter small towns and crossroad villages, they often become the “main street” used by all modes. When small pockets of population, including tourists and seasonal population and/or employment, exceed approximately 1,000 people per square mile (400 people per square kilometer), the pedestrian design criteria used should generally be the same as for urban areas. In these areas sidewalks and pedestrian facilities should be provided throughout the village center.

Providing facilities for pedestrians with disabilities is just as important in rural areas as it is in urban areas. If a pedestrian route is located within a road or street right-of-way, the pedestrian route must be accessible.

All transportation projects need to consider pedestrians’ needs, including limited access freeways and highways that pedestrians cross or that intersect with streets that serve pedestrians. Because in Hawaii, highways are often the “main streets” of villages and towns, pedestrians often walk along and cross highways. Interchanges, bridges, and underpasses are also examples of

There are many areas in Hawaii where the highway is the “main street” of the village.

Pedestrians crossing the roadway in Paia Town, Maui

A jogger uses the shoulder along a Maui highway.

transportation facilities that need to be designed to facilitate pedestrian movement.

Installation of pedestrian facilities in natural areas requires the same careful planning and design as other transportation facilities; using care to avoid impacts to sensitive natural, cultural, and historical resources while at the same time providing a good design solution that sufficiently serves the needs of all pedestrians. Refer to Toolbox Section 4 for more information.

Project-Level Considerations

The following guidance applies to planning and considerations related to design and development of specific transportation improvement projects. This includes street and roadway improvements, as well as other types of transportation facilities that pedestrians use.

Consistent with Hawaii's policy on "Complete Streets," project-level planning for streets and roadways, transportation corridors, transit, and intermodal facilities shall consider and address pedestrian needs just as much as any other mode. Complete streets policies encourage a systematic look at integrating pedestrian, bicycle, and transit facilities into the transportation network. For more information about complete streets, refer to Toolbox Section 2.

As discussed earlier in this section, specific projects should be designed in accordance with context-sensitive principles that consider the environmental, scenic, aesthetic, historic, and land use impacts and provide access for all modes of transportation such as pedestrians, transit, and bicyclists. A context-sensitive project addresses the needs of pedestrians as an integral part of the transportation solution.

Specific recommendations for project-level planning that addresses pedestrians include the following.

- Analyze methods for keeping motor vehicle speeds at or below the preferred maximum speeds through design measures and traffic calming techniques.
- Pedestrian access should be provided along the entire length of the project, and the pedestrian realm should be designed to fit the adjacent context/land uses.

- Buffer pedestrians from high-speed and high-volume motor vehicle traffic through treatments such as additional width between the sidewalk and the roadway or appropriate landscape buffers.
- Provide crossing facilities and treatments to ensure frequent and safe opportunities to cross the roadway/street. New construction or altered intersections, crossings, and other pedestrian facilities are required to provide accessibility features.
- Provide aesthetic quality and treatments that encourage walking, such as pedestrian-scale lighting, street trees, landscaping, and other features.
- In rural areas where pedestrians use the roadside shoulders, consider widening the shoulder to provide more space, or improving the roadside to include a sidewalk, walkway, or shared use path.

Phasing of Pedestrian Improvements with Development

Early planning for areas that are experiencing or are projected to experience growth and development is crucial. Retrofitting sidewalks into these areas at a later date is usually more difficult and expensive than installing sidewalks early in the process. Sidewalks may be phased in as development occurs and often are required improvements of developers as part of their projects. With new development, phased implementation of sidewalks should address the following.

- ***Dedicated Space for Future Sidewalks—*** Space for future sidewalks should be secured and/or reserved when a new right-of-way is being created or an existing one is being developed, and when future developments are indicated in land use plans. If existing rights-of-way are not sufficient in width, developers should be required to dedicate additional right-of-way to accommodate sidewalks and other facilities.
- ***Specific Criteria for When Future Sidewalks Will be Required—***In rural areas where sidewalks may not be installed as part of initial development due to lack of density, guidelines can be adopted to determine when sidewalks will be needed and how they will be funded and installed. For example, sidewalks could be required along residential streets once a certain density of dwelling units per acre is reached or at any time land uses are developed that will generate pedestrian activity (schools, parks, convenience stores, transit service, etc.).

There may be rural or natural areas where existing and proposed land use densities may not support installation of sidewalk improvements, or where installation of curb, gutter, and sidewalk along a higher speed roadway is not allowed. In these areas, if pedestrian use is likely to occur, conditions of approval should require installation of shared use paths separated from the roadway, as well as crossing treatments and other facilities to aid pedestrian travel in the vicinity of the project. Such facilities would need to be designed in compliance with AASHTO clear zone requirements.

The more pedestrians can walk to shops and to run errands, the less they have to drive, reducing traffic congestion on island roadways.

- ***Funding for Future Pedestrian Improvements—***If pedestrian improvements are not installed at the time of initial development, there should be clear regulations as to who (developer, property owner, or government agency) will pay for future sidewalks. Transportation impact fee programs, where developers pay in advance for future improvement needs in lieu of making physical improvements at the initial stage of the project can help to off-set the costs of sidewalks, intersection improvements, and other needs that may occur later. With these types of programs, funding often can be set aside specifically for future sidewalk improvements. Without these types of programs, it may not always be feasible or possible to have developers add sidewalks later after the development has been completed.

- ***Street Upgrades and Maintenance Projects—***Opportunities to expand or upgrade sidewalks and other pedestrian facilities should be considered as part of routine street upgrade, maintenance, and rehabilitation projects. Case law surrounding the Americans with Disabilities Act (ADA) has found that resurfacing an existing roadway constitutes an alteration, which requires the addition of curb ramps at intersections where they do not exist.

- ***Inter-Agency Coordination and Inter-Departmental Coordination between Infrastructure Projects—***Often, improvements needed for other infrastructure (such as for drainage, utilities, and street lighting) can provide an opportunity to install pedestrian facilities concurrently. Transportation and utility improvement projects should be coordinated to maximize efficient use of funds, leverage multiple funding sources where possible, and avoid conflicts. Removal or relocation of utilities should be carefully coordinated with other pedestrian improvements in order to maintain appropriate sidewalk clear width and avoid obstacles to pedestrians.

Jurisdictional responsibilities for land use and transportation planning are often covered by different agencies. For example, in Hawaii the city and county jurisdictions are responsible for land use, but HDOT is often responsible for the transportation facilities. Because land use is often an important factor in determining where pedestrian facilities are needed, it is important for the agencies responsible for land use to continue to closely coordinate with the agencies responsible for transportation.

Pedestrian Level of Service Analysis and Modeling

Pedestrian Level of Service (LOS) is typically an overall measure of walking conditions on a route, path, or facility. Pedestrian LOS is often influenced by the intensity of existing pedestrian use, as well as the density of surrounding land uses. It is typically a measure of pedestrian area occupancy, and planners often reference LOS when evaluating the need for pedestrian improvements. LOS measurements are often heavily influenced by current conditions. The best LOS analysis methodologies consider projected land uses and changes that may encourage pedestrian use in the future.

LOS can be linked directly to factors that affect mobility, comfort, and safety, reflecting pedestrians' perceptions of the degree to which the facility is "pedestrian-friendly." Factors are sometimes organized under three categories: physical characteristics, location factors, and user factors. Various models have been developed that measure LOS factors. These factors can be weighted by relative importance and a LOS scale is typically developed to describe the LOS of pedestrian routes.

When an LOS analysis is conducted, pedestrian conditions are often described through a LOS grade from LOS A (ideal pedestrian condition) to LOS E (unsuitable pedestrian conditions), based on an assessment of the factors affecting LOS. Refer to Toolbox Section 4 for additional information about these factors.

As discussed previously in this toolbox section, there are various new and emerging methods for evaluating walkability and pedestrian service levels. These include GIS-based tools, site surveys, walkability audits, and other approaches. Regardless of the outcome of any model or analysis process, it is always important to apply

WHAT TO AVOID IN LEVEL OF SERVICE (LOS) ANALYSES

While various methodologies have been developed for measuring LOS, some of the past models and analyses have used existing pedestrian volumes as a key factor. This can be problematic because research has shown that pedestrian activity can increase substantially after improvements are made in an area. Also, some LOS approaches tend to be macroscopic and not attuned to understanding specific on-the-ground conditions such as differences in pedestrian characteristics, specific land uses and location conditions, and crash types.

good professional judgment to the results. A scientific or computer-based model may show an outcome that on-the-ground conditions contradict. For this reason, a lot of jurisdictions prefer to analyze various overlapping conditions and make decisions without the aid of high-tech models or tools. Or they use these tools as one point of reference in decision-making, while also relying on other types of analysis and good professional judgment.

Study on the State of the Practice

The Institute of Transportation Engineers (ITE) is in the process of completing a study on the state of the practice related to determining the need for pedestrian improvements and policies/warrants for sidewalk installation. The results of this study may provide additional guidance for determining where and when to provide pedestrian improvements.

Other Resources

The following sources of information are recommended for general planning and design of pedestrian facilities.

- American Association of State Highway and Transportation Officials (AASHTO). *A Policy on the Geometric Design of Highways and Streets, 5th Edition.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *A Guide for Achieving Flexibility in Highway Design.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Planning, Design and Operation of Pedestrian Facilities.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Roadside Design Guide.* 2002.
- American Planning Association, Wiley & Sons, Inc. publishers. *Planning and Urban Design Standards*. 2006.
- Centers for Disease Control and Prevention, Walkability Audit Tool. ***http://www.cdc.gov/nccdphp/dnpao/hwi/downloads/walkability_audit_tool.pdf*** (May 2013).
- Duany, Andres. *Journal of Urban Design*, Special Edition Dedicated to the Transect. 2002.
- Federal Highway Administration. *Designing Sidewalks and Trails for Access, Parts I and II.* 1999.
- Federal Highway Administration. *Methods to Estimate Non-motorized Transportation Demand, Report FHWA RD-98-165.* 1999.
- Federal Highway Administration. *Pedestrian Facilities Users Guide—Providing Safety and Mobility, Report FHWA RD-01-102.* 2002.
- Federal Highway Administration. *Priorities and Guidelines for Providing Places for Pedestrians to Walk Along Streets and Highways.* 2000.
- Federal Highway Administration. *Public Involvement Techniques for Transportation Decision-Making.* 1996.
- Institute of Transportation Engineers, *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach.* 2010.

- Institute of Transportation Engineers. *Promoting Sustainable Transportation through Site Design: An ITE Recommended Practice.* 2010.
- Institute of Transportation Engineers. *Transportation Planning Handbook, 3rd Edition.* 2009.
- Transportation Research Board. *Going Public—Involving Communities in Transportation Decisions.* 2002.
- Transportation Research Board. *NCHRP Report 69: Performance Measures for Context Sensitive Solutions—A Guidebook for State DOTs.* 2004.
- Transportation Research Board. *NCHRP Report 480: A Guide to Best Practices in Achieving Context Sensitive Solutions*. 2002.
- Transportation Research Board. Dowling, R., et al. *NCHRP Report 616: Multimodal Level of Service Analysis for Urban Streets.* 2008.
- National Complete Streets Coalition. http://www.smartgrowthamerica.org/complete-streets (May 2013).
- Zeeger, Charles V., et. al. *Pedestrian Facilities User's Guide: Providing Safety and Mobility.* 2002.


INTERNATIONAL GALLERIES
612

TOOLBOX SECTION 2

Pedestrian-Friendly Streets

Streets are important public resources in communities—often places for parades, marathons, volksmarches, demonstrations, fairs, and festivals.

PEDESTRIAN-FRIENDLY STREETS

This toolbox section provides best practices recommendations related to planning and design of pedestrian-friendly streets. Guidance is provided for general street design, as well as for elements of streets that affect pedestrian travel (such as on-street parking, access management, traffic calming, and other topics). This toolbox section describes some of the most important characteristics of pedestrian-friendly streets, which will help communities and developers interested in creating more walkable settings. More specific design guidance for sidewalks and walkways is provided in Toolbox Section 4.

What are Pedestrian-Friendly Streets?

Pedestrian-friendly streets are often the most attractive and memorable streets in our communities. They are full of life and activity. Pedestrians are attracted to these streets not only because they are safe and accessible, but also because they are interesting places. They are the places people love to stroll, meet others, and go about their daily business.

Our streets and roadways are important public resources. In urban areas and village centers, the public street network often amounts to 40 percent or more of the total land area.

Streets need to be planned and designed to accommodate all modes of transportation. But pedestrian-friendly streets in particular should be designed with pedestrians as a high priority.

Awaiting a parade in Chinatown, Honolulu

IN THIS SECTION

Lahaina, Maui

Downtown Honolulu, Oahu

Various types of pedestrian-friendly streets are found in communities throughout the United States and abroad. "Complete streets," "sustainable streets," "green streets"—streets may be known by various names, and pedestrian-friendly streets possess many of the same characteristics as these types of streets. Most importantly, they convey a strong sense of place, and accommodating pedestrians is the main focus. Typical characteristics found along pedestrian-friendly streets are listed in Exhibit 2.1.

Roadway/Street Classifications

The design of roadways and streets varies depending on the width of the right-of-way, the function of the street, adjacent and nearby land uses, and the different modes of transportation that need to be accommodated. Some streets are wider, such as arterials, and carry more traffic, while others are narrower, such as local neighborhood streets, and carry less traffic. Street classifications can be a mechanism for organizing and classifying elements within the right-of-way, including pedestrian improvements and facilities. Different streets serve different purposes, and the types of pedestrian facilities and widths of sidewalks provided will vary depending on the purpose of the street.

The Hawaii Department of Transportation (HDOT) recognizes the Federal Highway Administration (FHWA) functional classification codes. Guidance related to sidewalk dimensions and locations for various roadway classifications is found in Toolbox Section 4—Sidewalks and Walkways.

Complete Streets

Complete streets share many of the same characteristics as pedestrian-friendly streets. They are planned, designed, operated and maintained to enable safe, attractive, and comfortable access and mobility for ALL users including pedestrians, bicyclists, transit users, motorists and persons of all abilities. In 2009, the Hawaii State Legislature passed Complete Streets legislation (Act 54) requiring HDOT and county transportation departments to ensure the accommodation of all users of the road, regardless of their age, ability, or preferred mode of transportation.

HDOT's Complete Streets Policy serves as a framework for implementing complete streets throughout Hawaii to allow the State and County systems to better serve all transportation users. It envisions a statewide transportation system that reasonably accommodates convenient access and mobility for all users of public highways, roadways, and streets statewide, including pedestrians, bicyclists, transit users, motorists, and persons of all ages and abilities while providing the safe and efficient movement of people and goods. The application of such transportation improvements, whether new construction or reconstruction, shall be context sensitive and complement the surrounding area, land use, and community. Every transportation project will provide the opportunity to apply complete streets principles in Hawaii.

Complete Streets principles will serve Hawaii's pedestrians. Key principles include:

1. ***Safety***—Plan, design, and construct transportation facilities and land developments to create an environment that reduces risk and supports the safe movement of people and goods by all modes.

EXHIBIT 2.1 Typical Characteristics of Pedestrian-Friendly Streets

Sufficiently wide and continuous sidewalks or separated walkways	Clear delineation and direction for pedestrians (special paving at edge of pedestrian area, easy-to-reach signal actuators, etc.)
Sidewalks and intersection improvements designed to accommodate accessibility needs (curb ramps, pedestrian signals, etc.)	Public spaces and pedestrian "pockets" adjacent to the main pedestrian travel way provide places to rest and interact (sidewalk cafes, benches, etc.)
Streets that are interconnected on a smaller grid to promote pedestrian access and mobility	Planting buffers, with landscaping and street trees provide shelter and shade without obstructing sight distances and help to soften the surrounding buildings and hard surfaces
Narrow lane widths and narrower streets that are scaled down for pedestrians and less conducive to high vehicle speeds (Note: street trees at the sides of streets create the perception of a narrower roadway.)	Street lighting at pedestrian scale (shorter light poles with attractive fixtures are effective in illuminating the pedestrian travel way but not obtrusive or harsh)
On-street parking where feasible	Awnings/covered building entrances and shade structures shelter pedestrians from adverse weather (particularly in transit areas)
The number of driveways is reduced/consolidated to minimize crossings/potential conflicts with pedestrians	Lively building and wall faces provide architectural relief, windows, or attractive surfacing
Traffic calming devices are provided to slow traffic, or if appropriate, reduce speed limits	Signs, information kiosks, maps and other elements help pedestrians find their way
Bus routes provide frequent service, special bus lanes, and bus pullouts	Street furnishings, such as benches, garbage receptacles, drinking fountains, and newspaper stands are provided in the furnishings/planter zone
Physically-separated or marked bicycle lanes (designated cycle facilities)	Public art, murals, banners, sculpture pieces and water features add character and a sense of place
Median refuge islands provide safe areas for crossing pedestrians	Colorful planters, holiday lighting, and other attractive features add color and life
Mid-block crossings and related improvements	
Curb extensions at intersections and mid-block crossings	

SUSTAINABLE STREETS

Through a variety of design and operational treatments, sustainable streets may give priority to pedestrian, bicycle, and transit use, and also may emphasize ecologically-friendly treatments. The treatments may include sidewalk widening, landscaping, traffic calming, sustainable materials, and other pedestrian-oriented features. The purpose of a Sustainable Street is to enhance and expand public open space, and to reinforce desired land use and transportation patterns on appropriate street rights-of-way.

2. ***Flexible Design (Context Sensitive Solutions [CSS])***—Design transportation facilities using best practices that integrate community values and recognize the importance of the surrounding context and environment.

3. ***Accessibility and Mobility for All***—Plan and design transportation facilities for ease of use and access to destinations by providing an appropriate path of travel for all users, and enhance the ability to move people and goods throughout the state and its counties.

4. ***Use and Comfort of All Users***—Ensure all users of all abilities including bicyclists, pedestrians, transit riders, and drivers feel comfortable and safe using the transportation system.

5. ***Health***—Recognize the health benefits in providing alternative mode choices.

6. ***Green Infrastructure/Green Streets***—Use trees and landscaping as integral components of a Complete Street to provide both human and ecosystem benefits, such as shade, to reduce the urban heat island effect, vegetation for carbon sequestration, reducing/filtering non-point source pollution and sediments, retaining stormwater, increasing groundwater recharge, and providing wildlife habitat.

On this Complete Street the pedestrian environment is improved with wide sidewalks, curb extensions, pedestrian traffic signals, and on-street parking. (CompleteStreets.org)

Sustainable Streets

Sustainable Streets often combine the practices of Complete Streets, Great Streets, Green Streets and the intent of the National Environmental Policy Act (NEPA). Opportunities for sustainable solutions in street and roadway rights-of-way bring benefits for business, people, and nature. Business is enhanced with aesthetic and site access improvements. People are accommodated with traffic and pedestrian safety improvements, and nature is carefully considered through stormwater management and the addition of green spaces.

The following are objectives of sustainable streets:

- ***Reduce Energy Consumption***—Support non-motorized travel and energy efficient movement of people and goods. Use resources with lower operations and maintenance requirements.
- ***Reduce Consumption of Material Resources***—Use recycled materials in construction. Require less infrastructure in solutions. Increase durability and life of design solutions.
- ***Reduce Impacts to Environmental Resources***—Minimize the impact on the natural environment. Encourage and support biodiversity. Reflect the historical and cultural context.
- ***Support Healthy Urban Communities***—Incorporate features that support community and livability, support public services and adjacent land use, and enhance public health, safety, and security.
- ***Support Sustainability During Implementation***—Support local economic, social and resource management needs during construction. Reduce environmental and community impacts during construction.

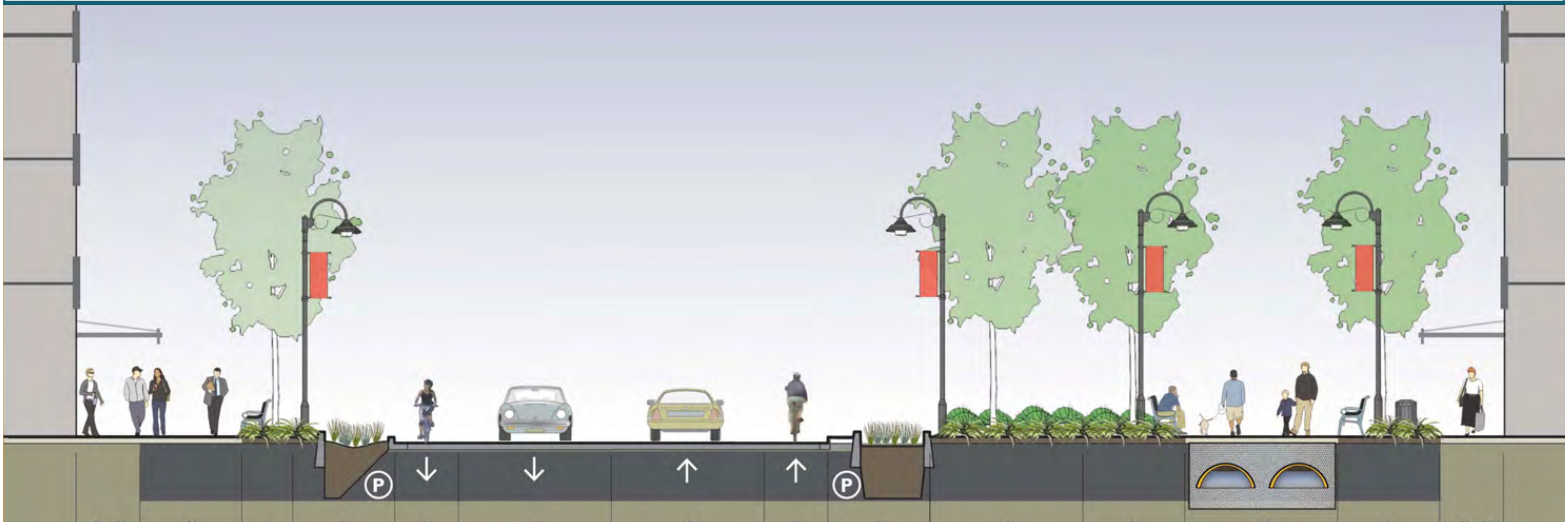
Green Streets

Green streets commonly integrate treatments to reduce stormwater runoff and associated pollutants. These may include rain gardens, filter planting strips, and other features. Stormwater planting and rain gardens next to sidewalks need to be carefully designed. Adequate width of the adjacent sidewalk should be provided to support the level of pedestrian use. With recessed planters, a raised edge wall or curb along the edge should be provided as a safety measure. Green streets may

Stormwater planters in Ontario, Canada

Shared streets can be designed without curbs. Large granite bollards take the place of curbs in this example from Chinatown Portland, Oregon.

EXHIBIT 2.2 *Example of a Green Street with Integrated Stormwater Features*



also transform some impervious surfaces within the right-of-way into landscaped green spaces that capture stormwater runoff and let water soak into the ground, as plants and soil filter pollutants. A common example is the installation of rain gardens within curb extension areas near intersections and mid-block crossings. These features slow the flow of environmentally-detrimental runoff by reducing impervious surfaces. The techniques aim to return the streetscape as closely to its pre-development water-absorbing state as possible.

Shared Streets/Woonerfs

"Woonerf" is the Dutch name for a 'living street' in which the needs of motorists are secondary to the needs of all users of the street as a whole. This type of street functions as a "shared space" that may be used by pedestrians, playing children, bicyclists, low-speed motor vehicles, and sometimes vendors. In such applications, the street becomes a public place for people instead of a single-purpose conduit for automobiles. In a woonerf or shared street, vehicles may not impede pedestrians, who in turn may not unreasonably hinder the progress of drivers. These streets are typically narrower and all travel modes share the same paved surface so that there are no defined travel lanes. They often have a surface paved with unit pavers or colored concrete to differentiate from other types of streets. They are often constructed all at one level, without curbs or with minimal curbs, tactile warning strips, and other features to define edges.

Often seen in European cities, shared streets are now much more common in cities across North America. Many cities and communities use shared streets as flexible public space. They may close these street segments during festivals and special events, such as St. Patrick's Day or Mardi Gras. Shared streets can also serve as focus areas for street vendors and farmers markets. They may doubly share as pedestrian plazas or transit waiting areas. Shared streets are commonly an urban application—integrated into areas of cities where there is heavy pedestrian and multimodal traffic. They can also be found in the core of many small town centers and village squares.

Roadway/Street Elements

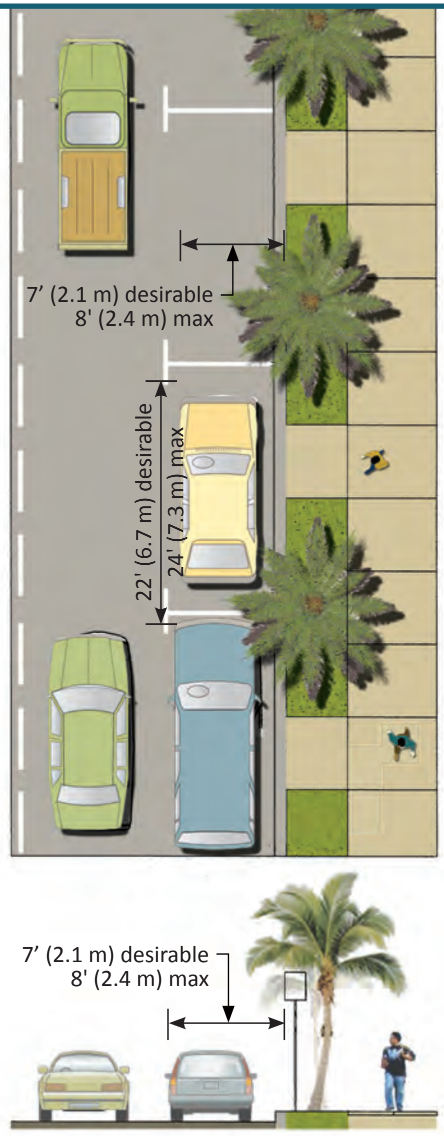
Pedestrian design considerations for roadways and streets are described below.

On-Street Parking

On-street parking can be beneficial for pedestrians because it provides a buffer zone between the roadway and the sidewalk, and its presence tends to reduce vehicle speeds. This includes on-street parallel parking and angled parking. On-street parking is often provided in urban areas and town centers. It allows people to access the sidewalk and adjacent businesses directly from their vehicles, and it increases street activity. For these reasons, on-street parking is often supported in business and shopping districts, neighborhoods, and other high activity areas. Exhibit 2.3 illustrates how on-street parking provides a buffer between street traffic and pedestrians.

On-street parking may present problems when there is not enough space for people to safely get out of their cars or walk between cars. On roadways where there are neither adjacent pedestrian facilities nor delineated crossings, parking is not desirable because pedestrians may be forced to walk in the roadway to get to their destination. They may also cross at several points along the roadway. A common cause of crashes is the lack of visibility of pedestrians entering the roadway from between parked cars. For example, informal on-street parking adjacent to a park or ball field can be hazardous due to the high numbers of children who are not paying attention to traffic conditions.

***EXHIBIT 2.3** On-street parking acts as a buffer between street and pedestrian walkway. Periodic curb ramps along a planting strip can facilitate pedestrian access onto the sidewalk.*



ON-STREET PARKING DESIGN

The Institute of Transportation Engineers (ITE) Design and Safety of Pedestrian Facilities recommends:

- ***Restricting parking within 50 ft (15.2 m) of all intersection and mid-block crossings where the speed of travel is 35 to 45 mph (56 to 72 km/h) and within 100 ft (30.5 m) of crossings on streets where the speed of travel is above 45 mph (72 km/h);***
- ***A setback of less than 50 ft (15.2 m) is desirable with 20 ft (6.1 m) minimum in central business districts, downtowns, or areas where travel speeds are typically slower (25 to 35 mph or less) and at signalized intersections or crossings; and***
- ***A setback distance of 100 ft (30.5 m) may also be appropriate:***
    - ***near schools where many children are crossing;***
    - ***at intersections or crossings that are not signalized; and***
    - ***on roadways with higher speed limits and elements that affect sight and stopping distances (curves, bridges, vegetation, etc.).***

DESIGN OF ON-STREET PARALLEL PARKING

The American Association of State Highway and Transportation Offices (AASHTO) Green Book indicates a desirable width of 8 ft (2.4 m) for on-street parking, but allows flexibility. Some communities may use a minimum width of 7 ft (2.1 m) for on-street parallel parking stalls. A general rule of thumb is that the narrower the width of the stalls, the closer people will tend to park to the curb. The stall length for on-street parking spaces is typically 22 to 24 ft (6.7 m to 7.3 m). Reducing excessive length in stalls to fit many of today's smaller vehicle sizes can bring benefits, such as opportunities to add curb extensions at pedestrian crossings, as well as landscaping and stormwater treatment areas.

In all cases, it is important that parallel parking stalls provide adequate space for pedestrian movement around the parked car without forcing pedestrians into the stream of traffic. (Also see Toolbox Section 3—Accessibility for on-street accessible parking design guidelines).

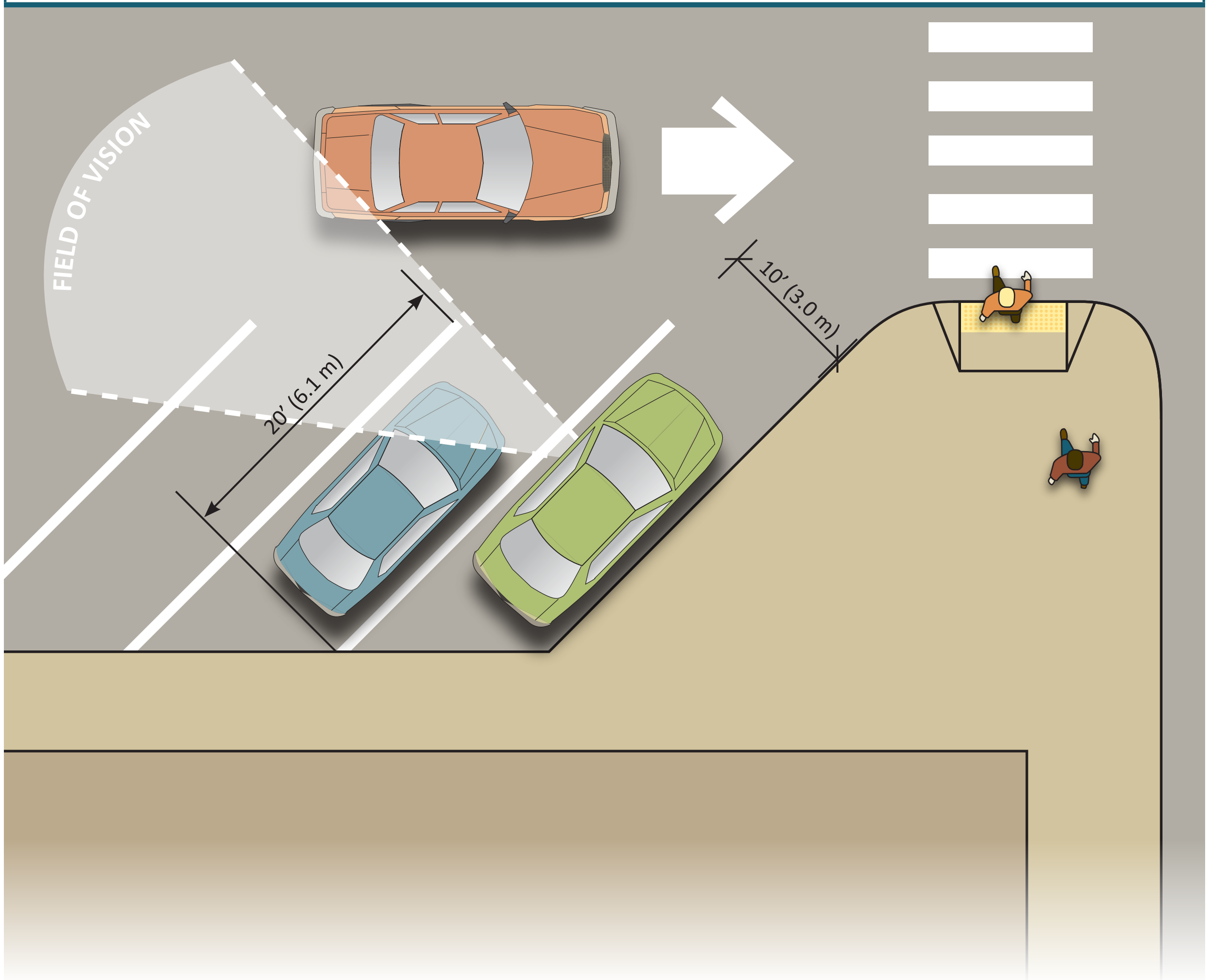
DESIGN OF ON-STREET ANGLED PARKING

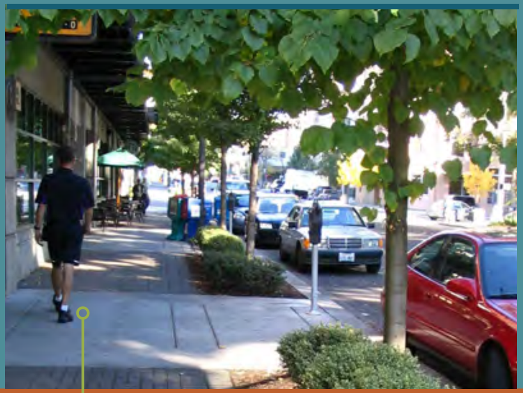
Typical dimensions for on-street angled parking stalls are: 60-degree angle stalls about 10 ft (3.0 m) wide and 20 ft (6.1 m) deep. Angled parking can either be front-in or back-in. Exhibit 2.4 illustrates back-in angled parking. Back-in angled parking provides motorists with better vision of bicyclists, crossing pedestrians and vehicles as they exit a parking space and enter moving traffic. Back-in angle parking benefits include clear sight lines when pulling out, ease of loading and unloading cargo, and protection for children because the open car door now directs young children back to a point of safety rather than out onto the street. Diagonal parking may require more attention to improve visibility at crossings and intersections, and it should not be used on high speed and high volume roadways. Please note that HDOT does not promote angled parking along state highways.

BIKE LANES ADJACENT TO ON-STREET PARKING

When bike lanes are adjacent to on-street parking, providing a buffer area (within the width of the striped bike lane), between the parking lane and the bike lane, allows space for car doors to swing without encroaching into the bike lane. A narrower parking lane helps to encourage cars to park tight to the curb, opening up more space for a buffer zone for the bike lane. When adjacent to parked cars, it is recommended that the bike lane be striped at a width of 6 ft (1.8 m). Increasing the bike lane width allows for additional maneuvering space and creates a narrower travel lane, which helps lower vehicle speeds.

EXHIBIT 2.4 ***Back-in Angled Parking***





Trees and parked cars provide a sense of enclosure and protection from traffic for pedestrians.

Example of back-in angled parking and bike lane

Parking Setbacks from Crossing Points

When on-street parking is provided, adjacent pedestrian walkways and clearly identified street crossing points are also necessary. On-street parking or loading zones that are too close to intersections and mid-block crossings can block views between pedestrians and motorists. Parking areas should be set back from intersections and crossings to allow pedestrians to see oncoming traffic and to enhance visibility.

Curb extensions (bulb-outs) at intersections and crossing points shorten the crosswalk distance and provide space for pedestrians to stand in better view of approaching vehicles. If curb extensions are provided, on-street parking does not affect the visibility of pedestrians. Exhibit 2.5 illustrates this situation.

Parking Overhangs

When perpendicular parking stalls are located adjacent to sidewalks, wheel stops or curbing are recommended to eliminate vehicle overhangs that impede required clear width of an accessible route. Exhibit 2.6 illustrates this treatment.

EXHIBIT 2.5 *On-street parking should be set back from the crosswalk so that pedestrians can see on-coming traffic, and motorists can see pedestrians.*

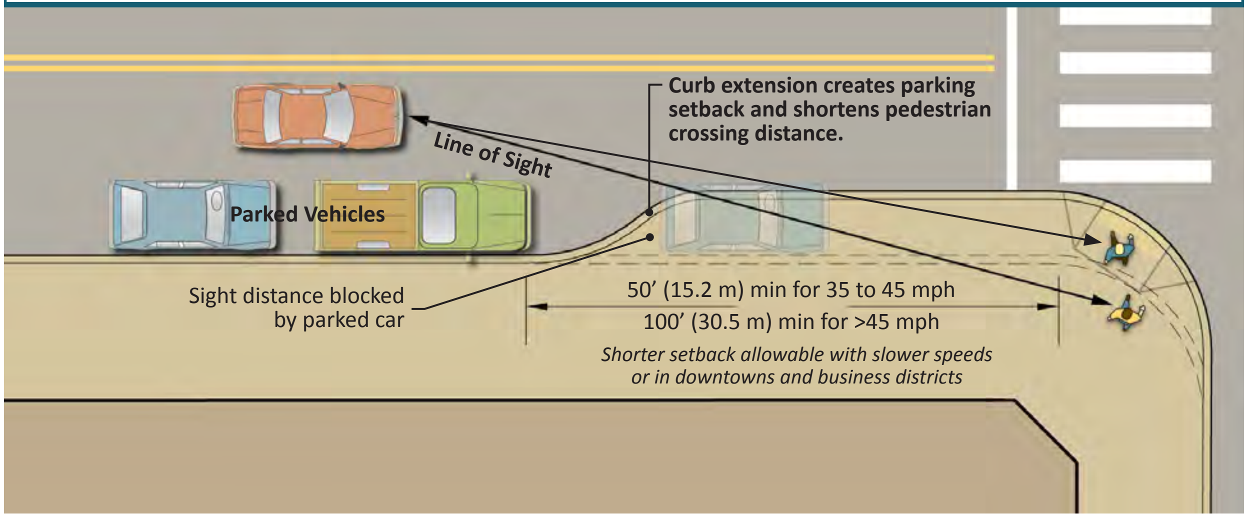


EXHIBIT 2.6 *Provide parking overhang space for perpendicular parking stalls.*

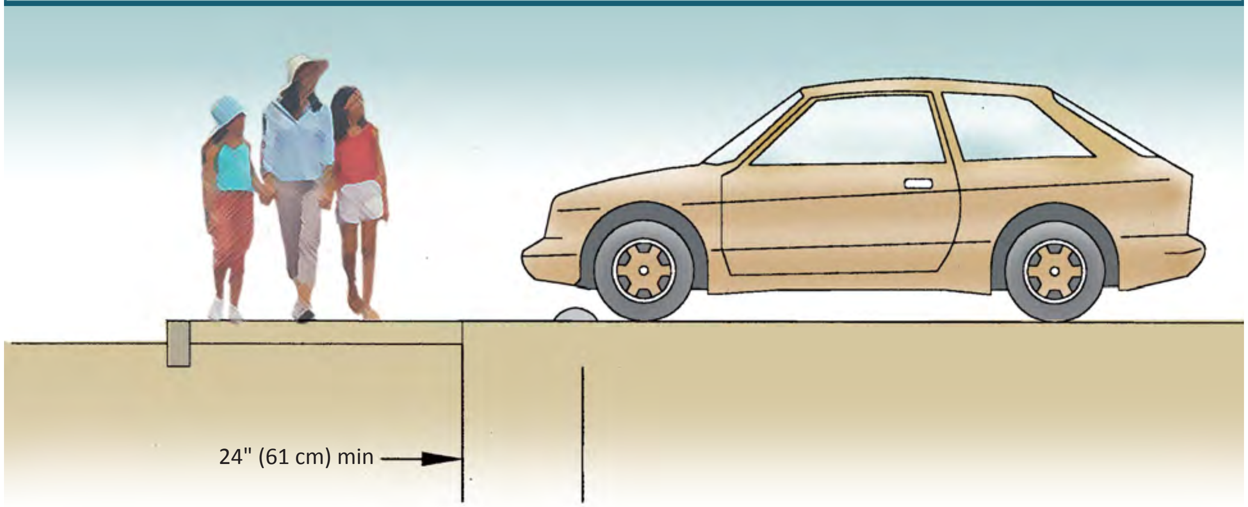
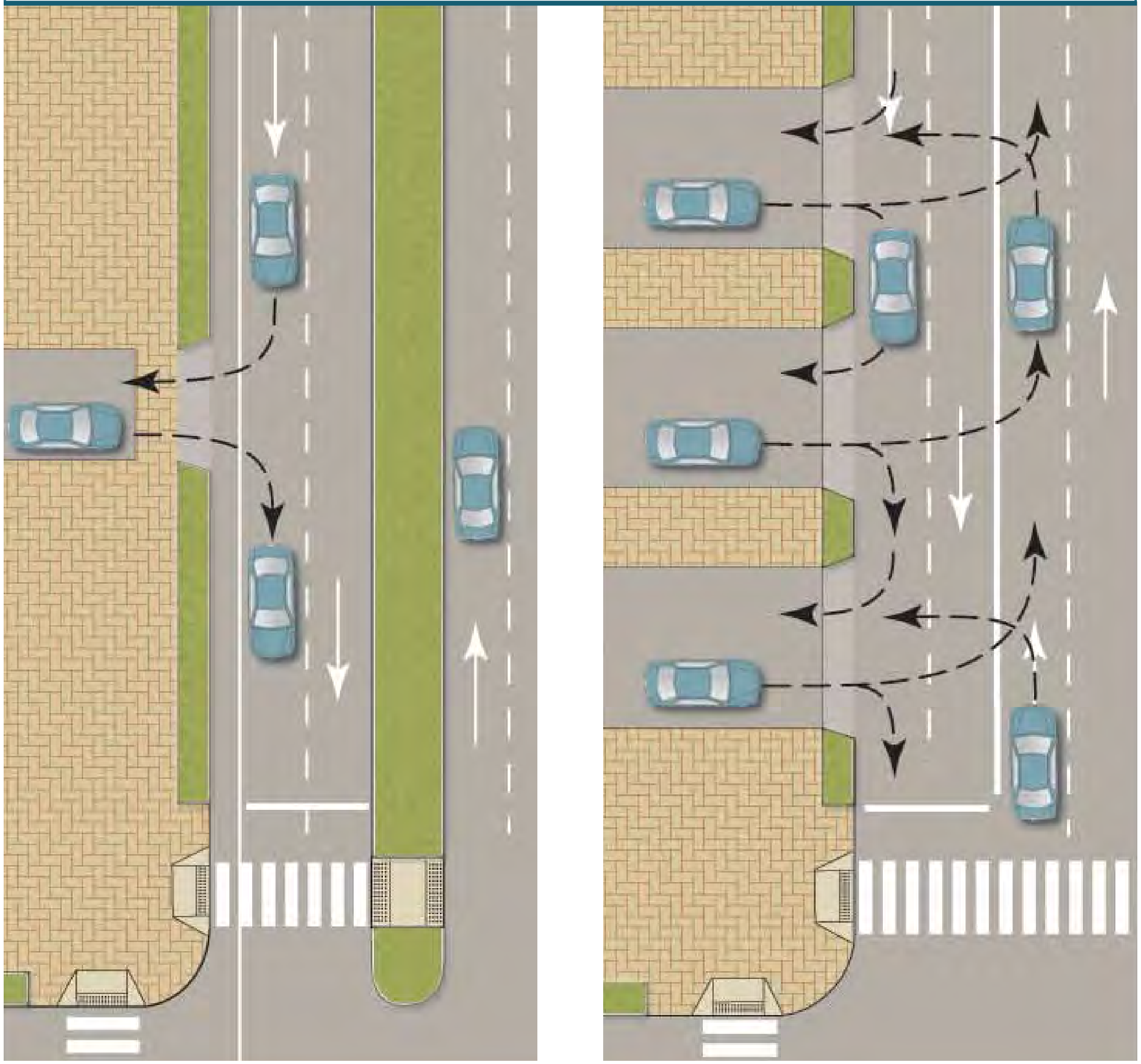


EXHIBIT 2.7 *Medians and fewer driveways reduce conflict points in the pedestrian realm.*



PREFERRED *AVOID*

Access Management

Well designed access management can benefit pedestrians because:

- Conflict points are reduced;
- Crossing opportunities are enhanced with an accessible raised median; and
- Improved traffic flow reduces the need for road-widening, allowing more space within the right-of-way for use by pedestrians, bicyclists, and enhancements, and maintaining fewer travel lanes to cross at intersections.

There are several access management techniques including:

- Reducing the number of existing driveways and consolidating driveways of parking areas and businesses; and
- Providing raised or landscaped medians or concrete barriers in the roadway center to control turning movements.

Exhibit 2.7 illustrates how controlled access and limited driveways reduce conflict points between pedestrians and motorists. Good design can minimize conflicts where driveways and walkways intersect.

A Note about the Disadvantages of Uncontrolled Access—Most pedestrian/motor vehicle crashes occur on busy streets, intersections, driveways, and alleys. Uncontrolled vehicle access to and from roads increases the potential of conflicts between pedestrians walking along the roadway and cars entering or leaving the roadway. Pedestrians crossing the roadway need gaps in the traffic stream. But with uncontrolled access, vehicles entering the roadway quickly fill the available gaps. Pedestrian access to transit may also be complicated by excessive driveway access points, creating obstacles on the way to the bus stop.

Driveways

Guidelines for designing driveways to optimize pedestrian mobility, accessibility, and safety are as follows.

- The number and width of driveways should be minimized.
- Space driveways a minimum of 75 ft (22.9 m) from intersections, with preferred dimension of 200 ft (61 m). (Check local and state requirements.)
- Consolidate driveways.
- Sidewalks should be continuous across driveways. The cross slope of the sidewalk should be maintained (2 percent max) and the driveway should be sloped so that the driver goes up and over the sidewalk.
- Access to private property can be designed in various ways. For pedestrian safety and comfort, the conventional driveway design is preferred because:
  - Motorists must slow down more when turning into the driveway.
  - The pedestrian right-of-way can be more easily established where the sidewalk is extended across the driveway.
  - Driveways that resemble intersections may encourage high-speed turns, and as such create hazards for pedestrians. They also create a longer crossing distance.

Exhibit 2.8 illustrates the preferred driveway

EXHIBIT 2.8 *Conventional driveway slows turning vehicles.*

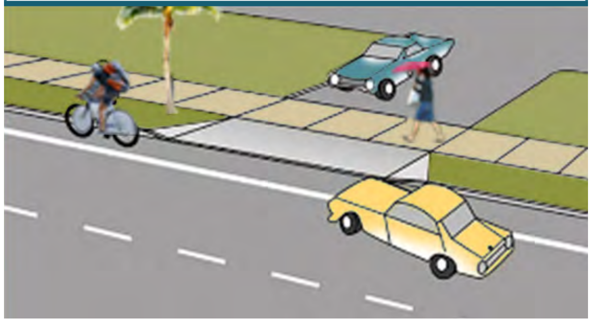


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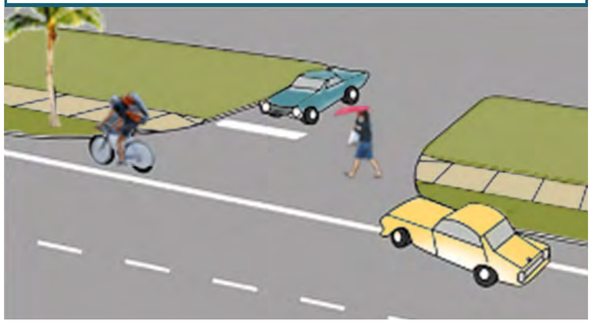
EXHIBIT 2.9 *Intersection-style driveway may encourage high-speed turns and create a longer crossing distance.*



AVOID

design solution. Exhibit 2.9 illustrates an intersection-like design that creates hazards for pedestrians and should be avoided.

- Where an intersection-style driveway must be used:
  - — The radius of the curb should be kept as small as possible;
  - — Driveway widths should be the minimum needed for entering and exiting vehicles; and
  - — Where the volume of turning vehicles is frequent, right-turn channelization should be considered, to remove slower turning vehicles from the traffic flow, allowing them to stop for pedestrians; or a traffic signal should be considered if warranted.

Traffic Calming

Traffic calming can bring benefits by slowing motor vehicles and making motorists more aware of the potential for pedestrians. Even though traffic calming is not specifically a "pedestrian facility," it relates to pedestrians by improving their environment.

Traffic calming is not appropriate for all streets. Traffic calming typically works best on lower speed streets in urban areas and village centers and in residential areas. A case-by-case analysis of each street or roadway should be completed to determine if traffic calming is appropriate, and if so, the specific types of traffic calming methods that will be most effective.

There are many types of traffic calming techniques and strategies. Traffic calming techniques use various means to influence the behavior of motorists: physical, psychological, visual, social, and legal (regulatory and enforcement). Exhibit 2.10 provides a quick reference guide for typical traffic calming goals and the methods for achieving the goal.

INTRODUCTION TO TRAFFIC CALMING/ WHY IS TRAFFIC CALMING USED?

The Institute of Traffic Engineers (ITE) publication *Traffic Calming: State of the Practice* provides the following definition for traffic calming: *"Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users."*

TRAFFIC CALMING

Most traffic calming treatments (other than speed reduction) are typically not appropriate for higher speed state highways and higher volume arterial streets. However, when the highway becomes the "main street" of a town or village center, or when an arterial is in a commercial business core or downtown, some types of traffic calming devices may be appropriate (such as on-street parking, street trees, curb extensions, or other treatments).

In the United States, the need for reduced speeds in residential areas is cited in ITE's *Handbook on Residential Street Design:* *". . . research has shown that pedestrians are not usually seriously injured when hit by a car moving at a speed of less than 20 miles per hour at the time of impact. If impact speeds are between 20 and 35 mph, injuries are usually serious, while at speeds above 35 mph they usually endanger life and are fatal."*

STUDIES AND STATISTICS

A study of 43 international traffic calming programs found that traffic calming solutions decreased traffic crashes by 8-100 percent (ITE *Traffic Calming: State of the Practice*).

Speed humps were associated with a 53-60 percent reduction in the odds of injury or death among children struck by an automobile in their neighborhoods (*American Journal of Public Health*).

The FHWA report *The Effects of Traffic Calming Measures on Pedestrian and Motorist Behavior* evaluated the effects of selected traffic calming treatments, at both intersection and mid-block locations, on pedestrian and motorist behavior.

EXHIBIT 2.10 ***Common Residential Traffic Calming Program Actions***

REDUCING	BY WHAT MEANS	EXAMPLES
Traffic volumes	Physical	Traffic diverters
Vehicle noise	Legislative	Speed limits, truck/bus restrictions
Visual impacts	Visual	Landscaping to block through views
Traffic speeds	Social, Physical	Neighborhood "Speed Watch" program, speed humps/ tables, radar speed signs
Crashes/speeding	Social, Physical	Neighborhood traffic circles, speed limits, strict speed enforcement, spot safety improvements
Exposure risk	Physical	Shorter crossing distances and priority at signals reduce pedestrian and bicycle exposure to the risk of a crash

"Before" and "after" data were collected in Cambridge, MA, Corvallis, OR and Seattle, WA. Data were also collected at "treatment" and "control" sites in Durham, NC, Greensboro, NC, Montgomery County, MD, Richmond, VA and Sacramento, CA.

Previous to the study, 16 speed humps were installed in 5 residential neighborhoods in Bellevue, Washington. The 85th percentile speeds declined from 36 to 39 mph prior to installation to 24 to 27 mph after installation.

Traffic volumes fell when alternate routes existed. Most residents felt that the humps were effective and favored their continued use.

Similarly, survey respondents in Ontario, Canada, reported speed reductions on five raised and narrowed intersections and seven mid-block bulb-outs, in conjunction with lowering the speed limit to 20 mph. The proportion of motorists who exceeded 20 mph was 86 percent before the devices were built, but only 20 percent afterwards.

RESIDENTIAL AREAS

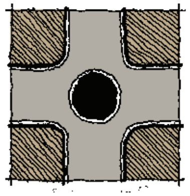
Traffic calming programs are often focused in residential areas to reduce traffic speeds and volumes on streets, making them safer for pedestrians, bicyclists, and those with special needs (children, older adults, and people with physical challenges and disabilities).

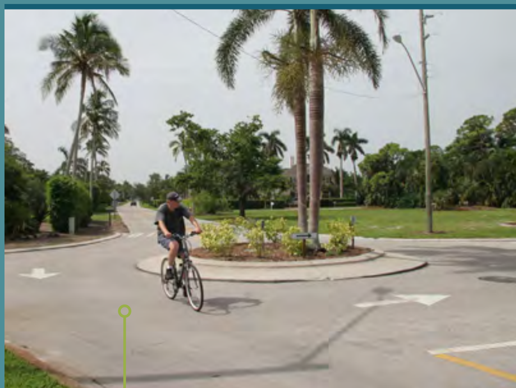
Although traffic calming techniques are also used in areas other than residential neighborhoods, most programs are focused on areas where traffic problems impact the day-to-day livability of the community. Traffic calming brings benefits to residential areas because it not only reduces speed and improves safety, but also reduces traffic noise and enhances the neighborhood. A wider range of techniques is generally more acceptable in residential areas where streets provide local access and do not function as major conveyors of commuting traffic.

TRAFFIC CALMING METHODS AND TECHNIQUES

Exhibit 2.11 illustrates some of the more common types of traffic calming methods currently used. Each of the techniques has successfully resulted in slowing traffic and reducing crashes.

EXHIBIT 2.11 Traffic Calming

COMMON TYPES OF TRAFFIC CALMING METHODS						
			TYPICAL APPLICATIONS:		CONTROLS:	
DRAWING	TECHNIQUE	DESCRIPTION	ARTERIAL	LOCAL	VOLUME	SPEEDS
	**Traffic Circles**	• Circular islands centered within intersections • Can be landscaped or surfaced with special paving • Landscaping can be maintained by the local jurisdiction or neighborhood volunteers • Speed humps on approach to the circle can promote the smooth flow of traffic at slow speeds of about 20 to 25 mph • Traffic circles are smaller than the larger roundabouts that focus on moving traffic • Often found at the cross streets of residential neighborhoods		x	Possible	Yes
	**Chicanes**	• Alternately placed curb extensions into the street that force motorists to drive in serpentine pattern • Offset from each other in mid-block locations • Can be used to keep through-trucks (versus local deliveries) off residential streets		x	Possible	Yes



Example of a traffic circle

Curb bulb-out (Dan Burden)

EXHIBIT 2.11 Traffic Calming, Continued

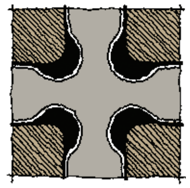
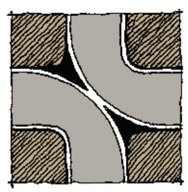
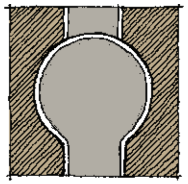
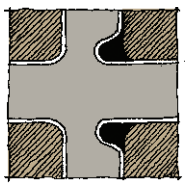
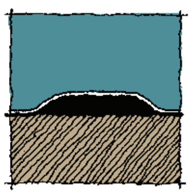
COMMON TYPES OF TRAFFIC CALMING METHODS						
			TYPICAL APPLICATIONS:		CONTROLS:	
DRAWING	TECHNIQUE	DESCRIPTION	ARTERIAL	LOCAL	VOLUME	SPEEDS
	**Curb Bulb-Outs, Chokers/ Neckdowns**	• Curb extensions at mid-block locations or intersections provide visual distinction and reduce pedestrian crossing distances • Help to provide a clear visual signal to drivers that a crossing is approaching • Make waiting pedestrians more visible and allow them to better see oncoming vehicles • Neckdowns are often longer than bulb-outs and may line up with and help define parallel street parking areas • Narrow the appearance of the street and can be attractive, especially when landscaped • Can provide space for furnishings and streetscape elements	x	x	Possible	Yes
	**Diagonal Diverters**	• Diverters eliminate through traffic while providing partial access in opposite directions • The island can become an amenity and provide refuge for pedestrians	x	x	Yes	Possible
	**Forced Turns and Partial Dividers**	• Truncated diagonal diverters (one end remains open) and other types of partial diverters discourage commuter traffic by forcing turns while still providing local access opportunities.	x	x	Yes	Possible

EXHIBIT 2.11 ***Traffic Calming, Continued***

COMMON TYPES OF TRAFFIC CALMING METHODS						
			TYPICAL APPLICATIONS:		CONTROLS:	
DRAWING	TECHNIQUE	DESCRIPTION	ARTERIAL	LOCAL	VOLUME	SPEEDS
	**Cul-de-sac/ Street Closures**	• Street is closed to vehicular traffic and turned into a cul-de-sac • End of street becomes a neighborhood amenity and focal point (landscaped mini park); the ongoing provision of pedestrian and bicycle access is important		x	Yes	Yes
	**One-Way Entry and Exit**	• Curb bulbs/extensions are used to close one lane of traffic at intersections • This approach stops through traffic but allows ingress or egress depending on the direction and location of the closure		x	Yes	Possible
	**Narrower Streets and/or Street Trees**	• Narrower streets limit the expanse of pavement visible to the driver and can be effective in slowing traffic, especially when lined with trees and/ or on-street parking • Street trees visually narrow the field of vision for motorists, causing them to move more slowly	x	x	No	Yes
	**Speed Humps/ Tables/ Cushions**	• Wider and smoother than a speed bump, and effective in slowing cars as they approach pedestrian zones • Most appropriately used on neighborhood streets • Cushions provide space for emergency vehicles to drive through rather than over the ramp		x	Possible	Yes

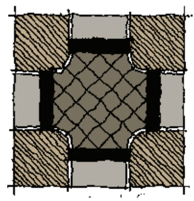
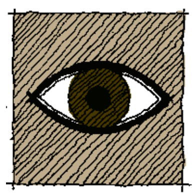
Speed cushions (Dan Burden)

Narrowed street with trees

Special paving used at a crossing (Dan Burden)

Palms serve as neighborhood gateway

EXHIBIT 2.11 ***Traffic Calming, Continued***

COMMON TYPES OF TRAFFIC CALMING METHODS						
			TYPICAL APPLICATIONS:		CONTROLS:	
DRAWING	TECHNIQUE	DESCRIPTION	ARTERIAL	LOCAL	VOLUME	SPEEDS
	**Signs and Neighbor-hood Gateways**	• Signs such as "Residential Street" or other terms can help to deter through traffic • Monuments and landscaping that identify neighborhood districts can be effective, especially when used in conjunction with other techniques	x	x	No	Yes
	**Special Paving**	• Alternate road surfaces, such as brick, colored concrete or special pavers, can be used at crossings, intersections, or along the sides of the street (must meet MUTCD requirements) • Breaks up the visual expanse of pavement and define pedestrian travel areas	x	x	Not Likely	Yes
	**Police Enforce-ment Speed Watch Programs**	• Police, as well as citizens and organizations, can utilize electronic sign boards to measure speeds of passing vehicles in their neighborhoods • Letters of warning can be sent to the registered owners of offending vehicles • Promote neighborhood awareness of speeding	x	x	No	Yes

Note: Other emerging practices are being developed on an ongoing basis. Check with local jurisdictions and HDOT for other possible solutions.

Bicycle Facilities

How bicycle facilities are located and designed directly affects the pedestrian environment. Often, pedestrians and bicyclists may have competing needs. It is important that designers understand these so they can adequately address both sets of needs. It should be noted that bicyclists enjoy traveling through environments that are active and interesting, just as pedestrians do. Refer to HDOT for standards and details on any bicycle requirements within the street design area.

Common types of bicycle facilities in the United States include:

- Bike lanes (on-street lanes for cyclists)
- Yield lanes where bicyclists and motorists are sharing the lane, and sharrows may be used to delineate the shared space
- Shared use paths where bicyclists and pedestrians share a path that is separated from the street (either inside or outside the right-of-way)
- Cycle tracks, located for exclusive use by bicyclists, are physically separated from motor traffic and are distinct from the sidewalk.

Cycle tracks can be separated from motor traffic with car parking, medians, a difference in grade level, and/or other features. They may be at the road level, sidewalk level, or an intermediate level. *Note: cycle tracks are common in some European cities and are gaining popularity in the United States.*

Exhibit 2.12 illustrates some of these types of on-street bicycle facilities, including a typical bike lane, a bike lane adjacent to on-street parking, a typical yield lane/shared lane (with sharrow treatment), and cycle tracks.

PEDESTRIANS AND BICYCLISTS AT INTERSECTIONS

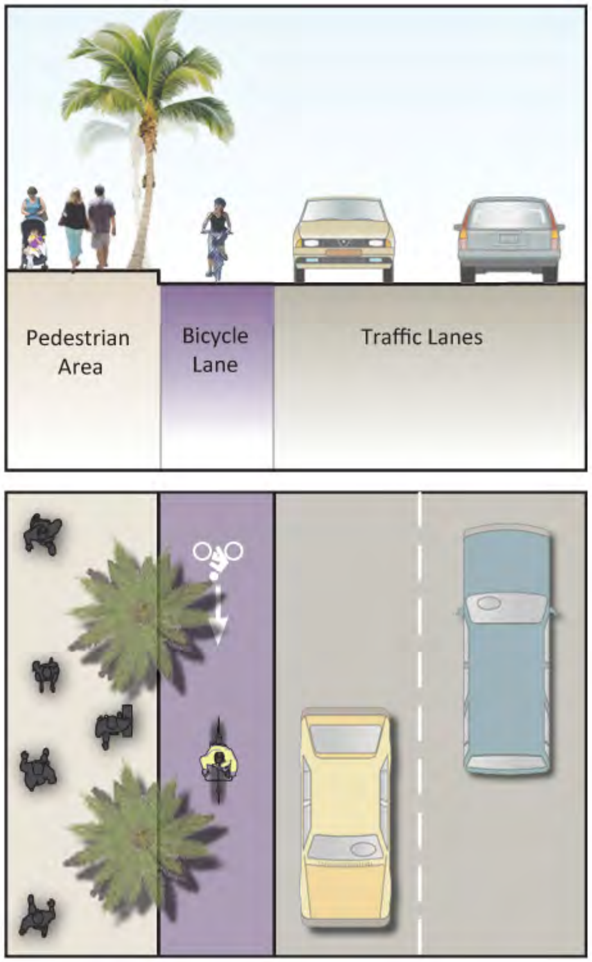
Because pedestrians move more slowly than bicyclists and some pedestrians with disabilities have special needs at crossings, intersection and crosswalk design is typically geared toward pedestrians' needs (in terms of signal timing, crossing phases, etc).

Bicyclists typically have the option of either moving with traffic in bike lanes or cycle tracks, or they may choose to dismount their bicycles and cross the street as pedestrians, following the same procedures pedestrians would. At

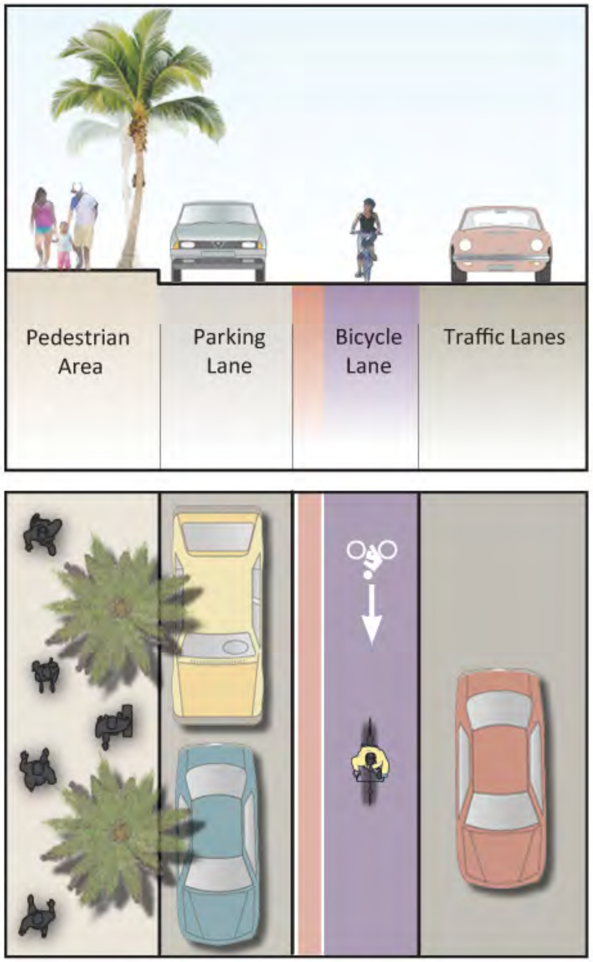
Bike rack in Honolulu, HI

Bike parking takes over former on-street parking space in Portland, Oregon.

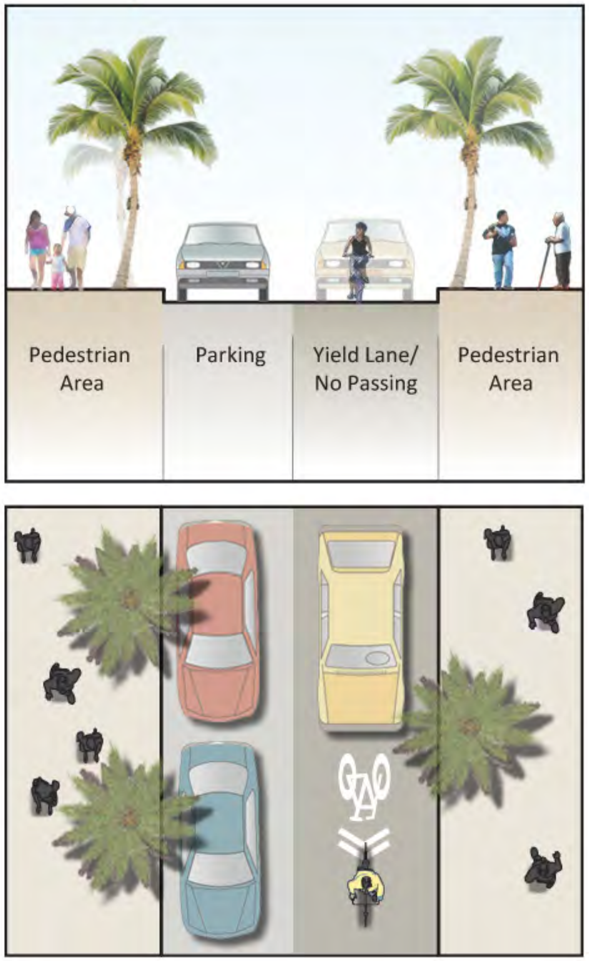
EXHIBIT 2.12 Bicycle Facilities in Street Right-of-Way



Bicycle Lane

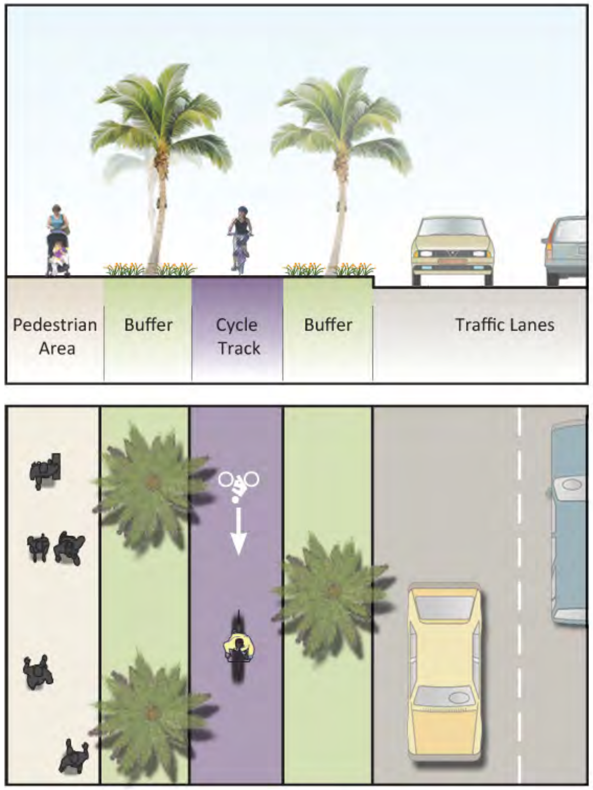


Bicycle Lane Next to Parking



Yield Lane/Shared Lane

EXHIBIT 2.12 *Continued*



Cycle Track

intersections where there are higher numbers of pedestrians and bicyclists sharing crosswalk facilities, crosswalks may need to be wider. Some communities are delineating crosswalk space specifically for bicyclists.

BICYCLE PARKING

Having widespread bicycle parking is also key to encouraging cycling – particularly for errands and commuting. It is generally recommended that, when provided, bike racks and bike lockers be located within the furnishings zone along sidewalks (see Toolbox Section 4), or in areas adjacent to the right-of-way, outside of the pedestrian through zone and the street/roadway clear zone. Appropriate design and placement of bicycle parking facilities is important to avoid conflicts with pedestrian mobility and accessibility. See ***Bike Plan Hawaii*** for guidelines on the location of bike racks.

Sidewalks, Walkways, and Sidewalk Corridors

The sidewalk corridor includes elements located within street rights-of-way that are adjacent to or parallel with the roadway. This includes all elements from the property line to the edge of the roadway, including pedestrian sidewalks or walkways, planting strips, furnishings zones, and frontage areas. For more information, refer to Toolbox Section 4—Sidewalks and Walkways.

Signing and Wayfinding for Pedestrians

A minimum of signing and wayfinding can be helpful to pedestrians. Most regulatory and warning signs are directed at motor vehicle traffic along streets and prior to crossings. Directional and informational signing installed for motor vehicle use may not adequately serve pedestrians. Pedestrians have different needs, characteristics, and desired routes. Because of their relatively slow travel speed, they need to know about the most direct and safest routes between origins and destinations, and where it is possible to cross roads, access buildings, link to public transport, and find facilities.

Pedestrian oriented signs enhance pedestrian circulation and sense of place. Care should be taken to identify key origins and destinations, such as schools, parks, libraries, museums, entertainment centers, and shopping districts.

SIGNING & WAYFINDING CHECKLIST

- Create a mission statement for the signing and wayfinding system
- Analyze specific urban conditions, including project goals, and vehicular, pedestrian, transit and bicycle routes
- Convene the stakeholders who will be involved in developing and maintaining the system. Understand their needs and design to address them.
- Review all regulatory requirements related to signing and wayfinding
- Use multiple design elements to devise a more complex system, instead of relying on one element
- Incorporate complementary design elements
- Limit the amount of information per sign to ensure visibility and comprehensibility
- Use colors and type that enhance legibility
- Create signs that are attractive to pedestrians, even if they are oriented only to motorists
- Plan route based on the history and development of the city
- Build signs to withstand physical, stylistic, and technological changes
- Develop a maintenance and management system prior to wayfinding system installation

Source: Planning and Urban Design Standards, 2006, Craig M. Berger, Society for Environmental Graphic Design, Washington DC.

Consider giving distances to these origins and destinations in blocks, average walking time, or other measurements meaningful to pedestrians. The provision of walking maps, including information about transit routes, makes it easier for pedestrians to find their way around a new environment. Some cities and towns provide maps inscribed in the sidewalk or on manhole covers. Information for pedestrians can also be displayed on kiosks or other designated areas.

Providing easy-to-read signs with simple phrases and graphics is important. Letters and symbols need to be bold with high contrast to the background. Generally, light letters and symbols against dark backgrounds are easiest to read.

As much as possible, signing needs to be understood universally, including non-English speaking people and children, especially in areas where there are a lot of tourists. The use of

EXHIBIT 2.13 *Signing and Wayfinding Examples*

DISTRICT IDENTIFICATION | VEHICLE & PEDESTRIAN DIRECTION | PEDESTRIAN INFORMATION

internationally recognized symbols can be an effective way to identify features to all pedestrians.

The “Signing and Wayfinding Checklist” (see sidebar on previous page) provides further guidelines for creating a cohesive system.

Furnishings and Utilities

Well-designed walking environments are enhanced by urban design elements and street furniture, such as benches, bus shelters, trash receptacles, and water fountains. Urban streetscapes should be carefully designed in order to provide adequate space for furnishings and utility facilities, such as light and signal poles, signal boxes, and fire hydrants. A continuous and clear travel way is required on sidewalks, walkways, and all accessible routes of travel. Additonal guidelines for streetscape furnishings can be found in Toolbox Section 4.

Context Appropriate Street Trees, Landscaping, and Sustainability

Landscaping and street trees in planting buffers and along streets can greatly enhance the pedestrian environment by softening the hardscape, providing shade and shelter, and fostering a vital connection to the natural world. Still, careful thought must be given to the selection of trees and shrubs installed.

In special districts, landscaping can be used to promote and create distinct individual identities. In accordance with specific guidelines and regulations in zoning code, landscaping is often required by local zoning codes for open spaces, setback areas, and all required yards to enhance the pedestrian experience.

The ability to remove street trees 6 in (15.2 cm) or greater in diameter may be limited. Remember to check local requirements that may apply to your project. If removal is warranted, replacement trees should be provided and may be required in some jurisdictions. Use of fragrant, lush, tropical vegetation and native plant species are encouraged. These include Coco Palms, Banyans, Monkeypods, Formosan Koa, Kukui, Plumeria, Wiliwili and Hau. All landscaped areas must be provided with adequate irrigation systems.

APPROPRIATE PLANT SELECTION IN PEDESTRIAN ENVIRONMENTS

- Street trees are typically spaced evenly along the street, ranging from 25 to 50 ft (7.6 to

Monkeypod - Samanea saman

Royal Palm - Roystonea regia

Plumeria - various species

Carob Tree - Ceratonia siliqua

15.2 m) apart, depending on the size of the tree at maturity. Trees can also be placed informally and clustered in areas. Do not locate trees where they will be an obvious obstruction to visibility.

- When tree wells are installed on urban sidewalks, they should be placed out of the pedestrian travel way. Tree wells can vary in size depending on the width of the sidewalk. Tree grates adjacent to or within sidewalks need to meet the accessibility requirements of the ADA—top mounted flush with grade and no openings larger than 0.5 in (1.3 cm) in diameter. Elongated openings shall be perpendicular to the dominant direction of travel.
- Street trees generally need a minimum width of 4 ft. More space may be needed for some species. Consult with a landscape architect or arborist to confirm spatial needs.
- Using low height shrubs and upward branching trees will maintain visibility and sight distance at intersections, driveways, crossings, and other critical areas along the street system. It is also important to consider how high and wide the shrubs and trees will be at maturity.
- Selection of plant material also needs to consider the availability of irrigation water, ways to minimize maintenance, and community preferences for landscape materials (such as the use of native species and informal plantings versus ornamental or formal landscapes).
- Parking structures, service areas, driveways, utilities, and blank walls should be screened from public view with the use of extensive planting. This can be established by the use of vertical and mid-height canopy form trees, flower shrubs, or non-invasive climbing or cascading vines. Designers may specify pre-fabricated trellis or cable systems or other types of green screening or living walls for these applications.
- Wherever possible, water runoff from roofs, planter boxes, and parking facilities should be directed to landscaped areas for retention and percolation.

Additional design guidelines related to landscaping adjacent to pedestrian facilities, including recommendations to minimize root damage to adjacent paved areas, are provided in Toolbox Section 7—Shared Use Paths. For more recommended species and additional information, see the *Honolulu Standard Procedures for the Planting of Street Trees* and future *Hawaii Department of Transportation Sustainable Landscape Master Plan*.

APPROPRIATE PLANT SELECTION NEAR UTILITIES

The location and depths of utility lines should be confirmed before developing the planting plan. Because trees spread as they grow and are effective conductors of electricity, steps must be taken to minimize electrical outages or safety hazards. Prior to planting, the Hawaiian Electric Company's (HECO) arborists should be contacted at (808) 543-7836 with questions regarding the placement and correct type of tree to plant.

Tall trees that can contact wires, poles or equipment should not be planted near overhead lines. According to the Planting Trees Near HECO Facilities Guidelines:

- Trees that mature at heights below 20 ft may be planted under lines.
- Trees that mature at 20 ft to 30 ft should be planted at least 10 ft horizontally from overhead lines.
- Taller, columnar trees should not be planted closer than 15 ft horizontally from overhead lines.
- Taller trees with spreading crowns that mature at heights greater than 30 ft should be planted at least 30 ft horizontally from overhead lines.

Large trees and/or trees with invasive roots must not be planted over or near underground lines. Refer to the HECO planting guidelines for a list of plants that may be planted in the vicinity of underground lines. Large tree species like Monkeypod, Albizia, Eucalyptus, and Banyan will require an onsite investigation by a HECO System Arborist to determine appropriate planting distance from any underground electrical facilities.

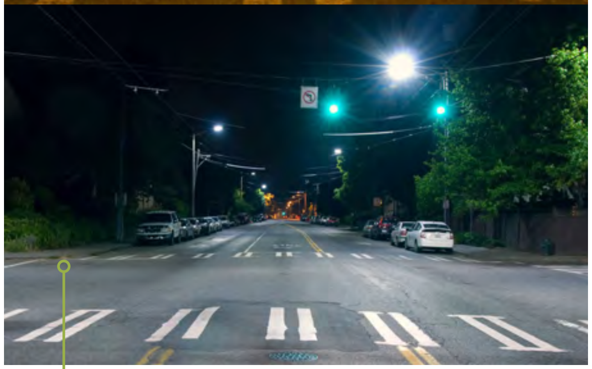
Living wall in Kailua, Oahu. (Yvonne Jaramillo Ahearn)

Street Lighting—Lighting the Travel Lanes and the Pedestrian Environment

Street lighting is designed to serve a variety of purposes. Primarily it facilitates visibility (clear, accurate, and comfortable) at night for motorists. National statistics indicate that more crashes occur at night, which in some cases could attributed to impaired visibility. Street lighting has also been shown to reduce pedestrian crashes, reduce fear of crime, and promote business through use of public streets and spaces at night. According to the Pedestrian and Bicycle Information Center (PBIC), in some locations lighting can reduce the odds of pedestrian fatalities by 42 percent at mid-block crossings and by 54 percent at intersections. Street lighting type, spacing, light levels, and equipment need to be designed to meet the appropriate jurisdiction standards.

The following design guidelines apply to general lighting of public rights-of-way:

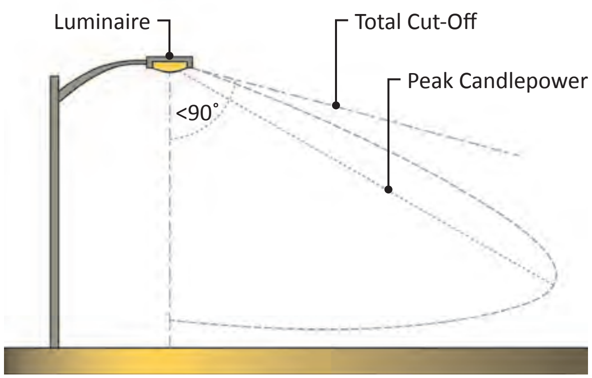
- Illumination along roadways increases the driver's ability to see pedestrians at night. Lighting should be provided along both sides of wide arterial roadways.
- Increasing the lighting in a sidewalk corridor can improve pedestrian access.
- Pedestrian-scale lighting encourages a sense of security and increases pedestrian activity, which in turn reinforces general safety.
- The preferred pedestrian-level lights are metal halide (MH), light-emitting diode (LED), or incandescent. Low-pressure sodium lights may be energy-efficient, but can create considerable color distortion. High-pressure sodium (HPS) lights produce less distortion and are a more desirable alternative.
- Choose energy efficient light sources, such as LED, that have a longer lamp life to minimize repeated replacement of lamps. LED technology is becoming competitive for outdoor applications with the commonly employed high intensity discharge light sources such as HPS and MH. The expectation is that LED street lighting technology will not only provide more efficient light distribution and increased uniformity, but will also save energy and reduce maintenance costs.
- Cut-off luminaires should be provided to minimize glare and light pollution.
- Street lights for motor vehicle lanes should generally be located in the edge zone or the median, while pedestrian lighting is best located in the frontage zone.
- Light pole locations need to be coordinated in design to avoid conflicts with other above and below grade utilities and street signing.
- Transition lighting should be provided along streets that lead from more intensely



Above: "Before" image of a Seattle street illuminated with high pressure sodium streetlights.

Below: "After" image of the same street with LED streetlights and much improved visibility. *(City of Seattle)*

EXHIBIT 2.14 ***Cut-Off Luminaire***



illuminated urban areas to outer, less developed areas. This involves a gradual change in lighting level as motorists transition to a different type of street and/or significant change in urban density.

- The spacing of street lights and trees establishes the rhythm of the streetscape. Street light spacing should be consistent along the length of a block or corridor, but flexibility in design is necessitated by infrequent driveway cuts. Lighting should be offset from street trees in a regular pattern, either mid-way between trees or at a consistent distance on either side, so that the tree canopies do not interfere with illumination coverage.
- Choose fixtures that are durable and resistant to vandalism and environmental conditions.

SPECIAL CONSIDERATIONS RELATED TO PEDESTRIAN LIGHTING

Lighting of sidewalks at a pedestrian scale increases security and pedestrian safety and comfort. Environments with high levels of pedestrian activity require more intense and even lighting because pedestrians move at a slower pace, look at more detail, and stop frequently for longer periods of time when compared with people in a moving vehicle. Standard street lighting fixtures on tall poles are not sufficient to meet the needs of pedestrians. However, a pedestrian-scaled light fixture may be integrated and/or retrofitted into the pole design. Guidelines are as follows:

- When introducing a new lighting system to replace or supplement the existing street lighting, incorporate light posts and fixtures that are pedestrian-friendly (shorter and more in scale with pedestrians, with less obtrusive and harsh light sources). Certain locations may require additional lighting (beyond uniformly spaced fixtures) to meet the prescribed lighting levels, including:

Special lighting allows pedestrians to navigate this waterfront path by day or night. (Dan Burden)

Existing street light poles can be retrofitted with pedestrian fixtures

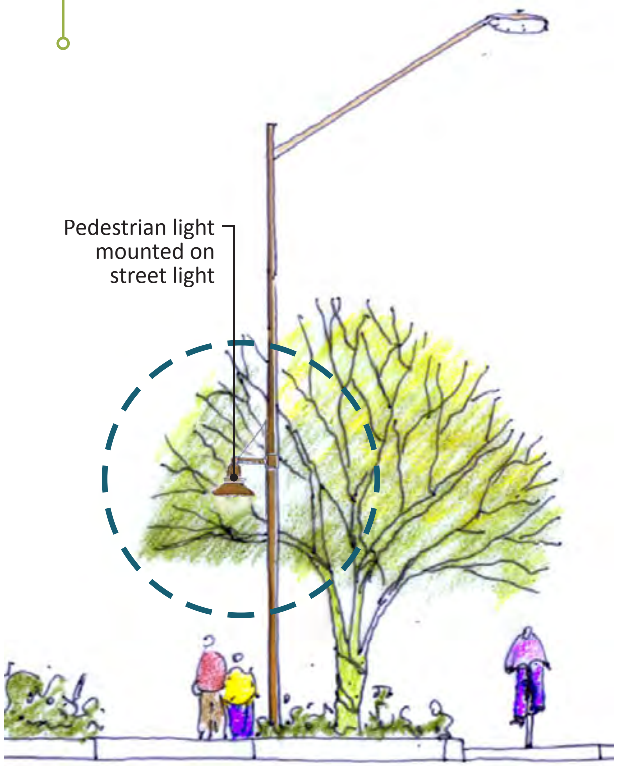
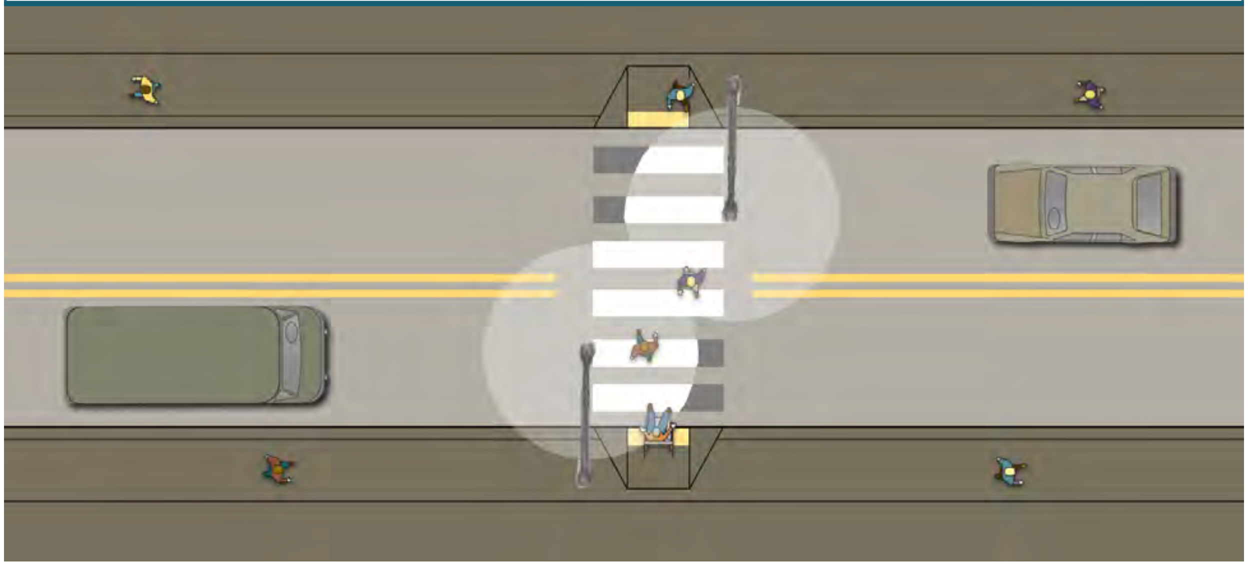


EXHIBIT 2.15 ***Nighttime Lighting at a Mid-Block Crossing***
(Adapted from Hawaii County Pedestrian Safety Action Plan Template, Draft)



- Intersection crosswalks and mid-block crossings (see Toolbox Section 5—Intersections and Crossings)
- Stairs and ramps
- Transit stops
- Pedestrian underpasses
- Building entrances
- Plazas and public spaces
- Parking garages
- Under awnings and colonnades

- Pedestrian lighting fixtures shall be spaced closely and evenly to allow the use of lighting fixtures with low wattage luminaires, as opposed to a less frequent spacing of fixtures that require high wattage. This approach will reduce the overall lighting power density, reduce glare, and provide consistent lighting levels.

Lighting should be evenly distributed to avoid alternating bright and shadowed areas. Lighting should be designed to increase recognition of other people and not create inordinate shadows. The best type of lighting for pedestrians focuses on the sidewalk and shines down rather than out.

- Provide between 0.5 and 2.0 footcandles of light along pedestrian travel ways, depending on conditions. A minimum intensity of 1 footcandle is required on the surface of accessible routes of travel.
- The same requirements regarding placement of light poles to avoid conflicts with trees and utilities mentioned for street lights apply for pedestrian lights.

LIGHTING TO ENHANCE NEIGHBORHOOD/ DISTRICT IDENTITY

Some designers use lamp styles to provide a sense of neighborhood continuity or preserve the atmosphere of a historic district. Specialty light pole styles can be selected to convey a particular theme or design character in coordination with the local municipality.

Light poles can include brackets for hanging banners for special events or to reinforce district/neighborhood identity.

Different types of illumination should be chosen with great attention, taking into consideration land use, population characteristics and the goals and objectives of each community.

Other Resources

The following sources of information are recommended for planning and design of pedestrian-friendly streets.

- American Association of State Highway and Transportation Officials (AASHTO). *A Policy on the Geometric Design of Highways and Streets, 5th Edition.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *A Guide for Achieving Flexibility in Highway Design.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for Development of Bicycle Facilities, 4th Edition.* 2012.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Planning, Design and Operation of Pedestrian Facilities.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Roadside Design Guide.* 2002.
- American Planning Association. Ewing, Reid, and Brown, Steven J., *US Traffic Calming Manual.* 2009.
- American Planning Association, Wiley & Sons, Inc. publishers. *Planning and Urban Design Standards.* 2006.
- Bain, Lesley, Gray, Barbara, and Rodgers, Dave. John Wiley & Sons. *Living Streets—Strategies for Crafting Public Space.* 2012.
- Federal Highway Administration. Kirschbaum, J.B., Axelson, P.W., Longmuir, P.E., Mispagel, K.M., Stein, J.A., and Yamada, D.A. *Designing Sidewalks and Trails for Access, Parts I and II.* 1999.
- Federal Highway Administration. *Informational Report on Lighting Design for Midblock Crossings.* 2008. www.fhwa.dot.gov/publications/research/safety/08053/index.cfm (May 2013).
- Federal Highway Administration. *Manual on Uniform Traffic Control Devices.* 2009.
- Institute of Transportation Engineers, *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach.* 2010.
- Institute of Transportation Engineers, *Traffic Calming for Communities.* **www.ite.org/traffic/index.asp** (May 2013).
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TOOLBOX SECTION

3

Accessibility

Just as we design roadways for use by a wide range of vehicles, so should we design sidewalks, transit stops, crossings, signals and other types of facilities for use by a wide range of pedestrians. *(www.pedbikeimages.org/DanBurden)*

ACCESSIBILITY

Everyone has an inherent right to accessibility. The overall intent of this toolbox section is to encourage design that accommodates all pedestrians, including people with disabilities and older adults. People with physical impairments and older adults have a wide range of abilities and needs, and they often rely on pedestrian travel and transit as their primary modes of transportation. Just as we design roadways for use by a wide range of vehicles, so should we design sidewalks, transit stops, crossings, signals, and other types of facilities for use by a wide range of pedestrians.

Everyone has an inherent right to accessibility (CompleteStreets.org)

Since accessibility guidelines for public rights-of-way (presented in the *Public Rights-of-Way Accessibility Guidelines*, also called PROWAG) vary from site development guidelines (presented in the *ADA Accessibility Guidelines*, also called ADAAG), each set of guidelines will be discussed in separate subsections, beginning on page 3-7.

Considering Accessibility in the Scope of Each Project

As designers begin each project, they should consider its scope and relationship to the jurisdiction's transition plan, if one has been prepared. Transition plans are typically done at the local level. In Hawaii, the State Department of Transportation and all of the counties have transition plans, which were developed to fulfill the requirements of the Americans with Disabilities Act (ADA).

As projects move forward, the need for accessibility improvements should be evaluated on a case-by-case basis. It is generally more cost effective to correct a known barrier by including it in a planned alteration project, rather than waiting to fix the problem at a

IN THIS SECTION

Select a solution that best balances the needs of all individuals. (www.pedbikeimages.org/DanBurden)

later date. The limitation of project scope or boundary to avoid a program access improvement could give rise to a complaint.

The scope of accessibility improvements should be related to and commensurate with the scope of the overall project, particularly with regard to roadway improvements. Each element that is altered as part of the project must be designed and constructed to be accessible to and usable by people with disabilities to the maximum extent feasible. Failure to provide accessible alteration project improvements may require a public entity, including responsible individuals, to defend their decision-making in court.

Planning, design, and development for accessibility should:

- Incorporate assistance from people with disabilities in the community. Consider their opinions and recommendations. Get input, advice, and support from local advisory committees, such as the Hawaii Disability and Communication Access Board (DCAB). In Hawaii, this is required per HRS 103-50.
- Recognize that the first solution to a problem may not always be the best. Look hard and wide for creative solutions.
- Be diligent in record-keeping. Document the analysis work, findings, and decisions. Save them in the permanent project record file.
- Select a solution that best balances the needs of all individuals: people who use wheelchairs, people who have vision impairments, and all pedestrians, young and old. Avoid solutions where roadway improvements are fully realized at the expense of pedestrian accessibility.
- Develop, adopt, and use a standard method of design review and approval.
- Provide defensible decisions, particularly in adversarial situations.

The recommendations above provide no guarantee that a project design will not be challenged. There will always be a second opinion or a different design solution. However, if the scope of the project is clearly defined, research is adequate, and the method of selecting the preferred alternative is clearly documented, the solution can be adequately defended. It is the designer's responsibility to provide the expertise needed to evaluate alternatives before confirming an engineering solution. Note that cost cannot be the basis for eliminating workable alternatives in a planned alteration.

Understanding the Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal law enacted in 1990 for the purpose of ensuring that all Americans have the same basic rights of access to services and facilities. The ADA prohibits discrimination on the basis of disability. To affect this prohibition, the statute requires certain designated federal agencies to develop implementing regulations. Section 504 of The Rehabilitation Act of 1973, a precursor to the ADA, created and extended civil rights to people with disabilities. The ADA, enacted later, called for specific guidance pertaining to design of accessible facilities.

The ADA Accessibility Guidelines (ADAAG) prepared by the Architectural and Transportation Barriers Compliance Board (also called the US Access Board) contain a wide range of administrative and procedural requirements, including compliance with design and construction guidelines.

The guidelines contained within the ADAAG are continually updated and current versions should be reviewed as part of the design process for every project. The ADAAG applies to new construction and alterations, but other legal requirements of the ADA cover improvements of existing facilities, including removal of barriers in places of public accommodation.

In recent years, much information has been developed to respond to the perceptions planners and designers have about what the ADAAG requires. Some of this information can be confusing and conflicting. ADAAG requirements are discussed at the end of this section.

In 1999, the US Access Board formed the Public Rights-of-Way Access Advisory Committee (PROWAAC) to develop guidelines for accessibility in public rights-of-way. Prior to the *Public Rights-of-Way Accessibility Guidelines* (PROWAG), applicable portions of

ACCESSIBILITY AND USABILITY ARE KEY CONSIDERATIONS

...for pedestrian facilities, which should accomodate pedestrians of all abilities.

- American Association of State Highway and Transportation Officials (AASHTO)

ADAAG were used to guide accessibility design within the public right-of-way, but ADAAG didn't discuss a number of significant issues related to pedestrian facility design within public rights-of-way. The PROWAAC published a report in January 2001 called *Building a True Community* that set forth the committee's recommendations. Hearings were held and the PROWAAC recommendations have been modified over time. The US Access Board released the proposed guidelines for public comment in summer 2012, and comments were gathered from the public through February 2, 2012. The guidelines are currently under review

Older adults often rely on walking and transit services to complete their daily errands. (Dan Burden)

People who use walking aids need carefully designed facilities that eliminate barriers. (Dan Burden)

by the Office of Budget and Management. The US Access Board anticipates publishing the proposed rule (with revisions to the draft rule based on public comments) in the near future.

Designing for People with Disabilities

Disabilities include a wide range of conditions (hearing and visual impairments, mobility limitations, etc.). Approximately 70 percent of all Americans will have a disability at some point in their lifetime, either temporarily or permanently *(Accessibility Design for All, An Illustrated Handbook)*. Disabilities can affect people differently and limit abilities to greater or lesser degrees. For this reason, some design approaches that accommodate one person may be a barrier to others.

Working closely with people who have disabilities throughout a project's design process can be an effective way to ensure that their needs are recognized and accommodated. The best guidance design professionals have for accommodating the needs of people with disabilities are the regulations and standards issued under the ADA Standards for Accessible Design. The Hawaii DCAB reviews and provides recommendations on project plans prior to construction. More information on the DCAB can be found at: ***http://hawaii.gov/health/dcab/home/index.htm*** (May 2013).

Spatial Needs for People with Disabilities

People with disabilities, including those using special walking aids or wheelchairs, need carefully designed facilities that eliminate barriers. The needs of pedestrians with disabilities can vary widely depending on the type of disability and level of functional limitation. Elements that are helpful to people with disabilities are listed in Exhibit 3.1.

Space requirements for pedestrians with disabilities vary considerably depending on their physical abilities and the assistive devices they use. Spaces designed to accommodate individuals who use wheelchairs are generally considered to be functional and advantageous for most people, including able-bodied pedestrians. Refer to the introductory section “General Characteristics and Needs of Pedestrians,” which illustrates the

EXHIBIT 3.1 ***Aids to Pedestrians with Disabilities***

Curb cuts and ramps
Tactile warnings
Easy-to-reach activation buttons
Audible warnings and message systems
Raised and Braille letters for communications
Signal timing at lower than average walking speed
Maximum grade of 1:20 and cross slope of 1:50 (ramps can be 1:12)
Roadway crossing refuges
Reduced roadway crossing distances (bulb-outs and curb extensions)
Traffic calming
Handrails
Smooth surfaces and unobstructed travel ways

spatial dimensions of a wheelchair user, a person on crutches, a person with visual impairment, and other pedestrians.

Designing for Older Adults

Older adult populations (over 65 years of age) are an important consideration because of their increasingly limited ability to drive. As populations age, transit accessibility and safe walking routes become more important. According to the Statewide Pedestrian Master Plan, the average elderly population in Hawaii is 13.3 percent, and the following areas have elderly populations that are higher than the statewide average:

- ***Oahu***—City of Honolulu and areas north and east (19 to 58 percent)
- ***Kauai***—Central south area of Waimea (5 to 28 percent)
- ***Maui***—Central valley (19 to 58 percent)
- ***Hawaii***—Some pockets of elderly populations near Kailua-Kona and north of Hilo

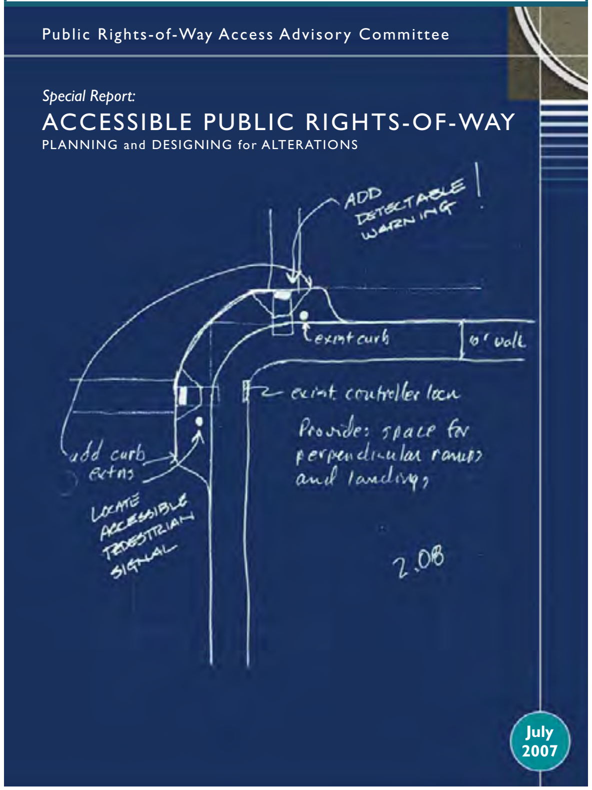
Exhibit 3.2 lists some examples of elements that aid elderly adults in their travel as pedestrians.

EXHIBIT 3.2 ***Aids to Older Pedestrians***

Reduced roadway crossing distances (bulb-outs and curb extensions)
Signal timing at lower than average walking speed
Signals within 59 ft (18 m) of viewing distance; easy-to-read signs
Refuge areas in roadway crossings
Traffic calming
Handrails
Smooth surface and unobstructed travel ways
Shelter and shade

All Americans have the same basic rights of access to services and facilities per ADA.
(www.pedbikeimages.org/DanBurden)

EXHIBIT 3.3 ***Special Report Accessible Public Rights-of-Way***
(Accessible Public Rights-of-Way Advisory Committee)



Older adults are often avid pedestrians. If retired, senior citizens may have more time to enjoy walking for exercise and recreation. Older adults often walk and use transit to do their daily errands. They sometimes use wheelchairs or motorized carts to travel along pedestrian routes. When walking, they may travel at slower rates and have less mobility, or they may have disabilities such as visual impairment and may be hard of hearing. Many of the same design recommendations for people with disabilities can be applied to accommodate older adults with these special needs.

Program Requirements

Much of the following discussion on Program Requirements and Project Scope is taken from *Special Report Accessible Public Rights-of-Way Planning and Designing for Alterations*.

In assessing their responsibilities for existing facilities, many jurisdictions have relied heavily on two helpful tools—the self-evaluation and the transition plan. (A transition plan was developed by HDOT in 1999.) These tools were initially required under both Section 504 of the Rehabilitation Act of 1973 and ADA Title II regulations. Many jurisdictions have continued to use these tools to plan for addressing accessibility issues, assessing progress, and managing changing circumstances. In addition, the Section 504 regulations require that jurisdictions establish a system for periodically reviewing and updating the self-evaluation that forms the basis for the Federal-aid transition plan.

A transition plan can provide decision-makers with an efficient tool for complying with Section 504 and ADA requirements and holds information that often is not available in other planning documents. An updated transition plan will identify and locate elements and features that need to be added or altered, processes for determining accessibility priorities, and information that can be used in assessing the 'undue burden' cost limitation. However, this only applies to existing facilities. Cost is not a determinant of infeasibility in new construction and alterations.

While many methods may be used to achieve program access in existing facilities, ensuring usability in an already-developed pedestrian circulation system (a program) is likely to require remedial construction. In some cases, a new construction or alterations project will give rise to a program access obligation. For example, when a bus stop sign is placed in a hitherto-undeveloped environment. The presence of an existing bus stop that is not yet served by the pedestrian facilities needed to make it accessible—a pad for the deployment of a bus lift, a sidewalk for access to the stop—is a clear indicator of program access improvements that may need to be constructed for full use of the transportation system.

An alteration project may differ from a new construction project because existing development may limit available space, access points and elevations. Where existing constraints in an alteration project prevent the full implementation of accessibility objectives, the ADA and Section 504 regulations provide a degree of flexibility to designers and agencies.

Alterations under the ADA are required to meet new construction criteria to the maximum extent feasible, and extensive reconstruction work can and should approach the accessibility required of new construction. For example, a project that calls for the removal of pavement and sidewalks to subgrade, followed by the installation of new sidewalks and pavement, is an alteration whose broad scope offers significant opportunity to incorporate the full range of accessible features. On the other hand, the installation of a single curb ramp at an existing intersection is an alteration with limited scope for correcting adjacent inaccessible conditions.

Designing for Accessibility in Public Rights-of-Way

As discussed above, PROWAG are the guidelines that should be used for pedestrian facilities within the public right-of-way. A number of technical elements are similar within both PROWAG and ADAAG, but the discussion below focuses on guiding design of pedestrian facilities within the public right-of-way. Guidance for the design of pedestrian facilities within sites beyond the public right-of-way is discussed at the end of this section under the “Site Pedestrian Facilities” heading.

Pedestrian Access Routes (PAR)

PROWAG refers to accessible paths as *Pedestrian Access Routes* (PAR) and ADAAG refers to them as *Accessible Routes* (AR). The “pedestrian access route” is the key element of accessibility. This term should not be confused with an "accessible route". AR is discussed under the "Site Pedestrian Facilities" heading at the end of this section. A PAR is the public right-of-way counterpart to the AR currently required in ADAAG. A PAR is a continuous, unobstructed path connecting all accessible elements of a pedestrian system. Where a pedestrian circulation path is provided in the street, along a highway, or within a shoulder, it shall contain a PAR.

The pedestrian access route can include walkways, sidewalks, street crossings, and crosswalks, and overpasses and underpasses, courtyards, elevators, platform lifts, stairs, ramps and landings. Where sidewalks are not provided, pedestrian circulation path may be provided in the street, highway, or shoulder unless pedestrian use is prohibited. (PROWAG Advisory R204)

Longitudinal Grades

Because of the constraints imposed by right-of-way width, the PAR is relieved of the slope limits that would apply to an accessible pedestrian route on a site provided it matches the general grade of the adjacent roadway. Where the

PAR is supported by a structure, such as an underpass, overpass, or bridge, it shall comply with ADAAG requirements.

Even though PARs are not required to have an accessible longitudinal gradient, the best practice is to design PARs at an accessible grade to the maximum extent feasible. Per ADAAG, an accessible grade is defined as a maximum of 1:20 or 5 percent. If the grade exceeds 5 percent, a ramp must be constructed. Longitudinal ramps along accessible routes of travel shall not exceed a maximum grade of 1:12 or 8.33 percent. When an accessible route is greater than 1:20, it is considered a longitudinal ramp (except for sidewalks along roadways) and must have handrails and landings. Longitudinal ramps are described in more detail under Site Pedestrian Facilities.

HANDRAILS

Walkways within public rights-of-way should not be considered to be ramps, and are not required to comply with the same criteria that ADAAG specifies for site and building conditions. Thus, handrails would not normally be required within public rights-of-way, although there may be situations where the designer would elect to include them.

If handrails project into a pedestrian circulation path in the street right-of-way more than 4 in (10.0 cm), they must include an extension to improve cane detectability for pedestrians with visual impairments.

SHARED USE PATHS

The US Access Board is currently seeking public comment on a new initiative to develop accessibility guidelines for shared use paths which provide a means of transportation and recreation for various users, including people with disabilities. The new guidelines will provide technical provisions for incorporating accessibility into the construction or alteration of shared use paths covered by ADA. This rulemaking will complement guidelines the board is developing for the Accessibility Guidelines for Outdoor Developed Areas (ODAAG) and PROWAG.

The draft technical revisions for shared use paths require a maximum longitudinal grade of 5 percent. However, a requirement for landings on shared use paths is not included. The entire draft guidelines are available at: ***http://www.access-board.gov/sup/anprm.htm*** (May 2013).

Landings on steep shared use paths create a choppy effect, are difficult to construct, and are a hindrance to bicycle travel. The best practice is to design shared use paths at a grade of 5 percent or less to avoid the need for landings and handrails. Although this may not be feasible with paths that follow the longitudinal grade of the roadway.

PAR Surfacing

PROWAG states “the surface of the pedestrian access route shall be firm, stable and slip resistant.” Hard surface paving (concrete, unit pavers, etc.) of the PAR is not required, but in order to achieve the requirements stated, hard surface paving is often the best surface solution that fulfills the requirement.

The surface within the PAR (a minimum width of 4 ft (1.2 m)) should include a “reduced vibration zone” that provides a smooth, stable, and slip resistant surface within the PAR. The purpose of the reduced vibration zone is to provide a smooth surface to reduce pain and discomfort for individuals who use wheelchairs. This surface should be free of utility covers, wide joints, and rough or bumpy surfaces, such as some rough surfaces resulting from unit pavers.

This walkway in Honolulu has a clear travel way and smooth surface.

Protrusions into the PAR are hazardous.

Sidewalk widens as it passes obstruction to maintain PAR width.

Per PROWAG, surface discontinuities along the PAR shall not exceed 0.5 in (13 mm) maximum. Vertical discontinuities between 0.25 in (6.4 mm) and 0.5 in (13 mm) shall be beveled at 1:2 minimum. The bevel shall be applied across the entire level of change.

Research has indicated that chamfers on unit pavers of less than 0.5 in (1.25 mm), if flush, are not distinguishable from cast-in-place concrete sidewalks with a broom finish, although as chamfer is reduced, the surface becomes even smoother. Unit pavers abutted without joints and with careful installation can also provide a smooth finish.

Spaces outside the PAR may be constructed of less smooth materials. This allows urban designers to be creative in the choice of paving materials over the full width of a sidewalk outside the reduced vibration zone.

Widths and Clearances

A clear width of passage, without obstacles such as signs, newspaper stands, and trash receptacles, needs to be provided for PARs. PROWAG requires a minimum 4 ft (1.2 m) wide path of travel, and it is recommended that this minimum width be a "reduced vibration zone." If the PAR is less than 5 ft (1.5 m) in clear width, passing areas must be provided. See "Passing and Resting Areas."

It is best to provide direct routes of travel as well, so that pedestrians do not have to change their course of travel to avoid obstacles. Exhibit 3.4 illustrates directioness of route.

Vertical clearance is also important to accommodate people with visual impairments. A PAR shall have a minimum clear height of 6 ft-8 in (2.0 m). 7 ft (2.1 m) is recommended as a preferred vertical clearance. Where the vertical clearance of an area adjacent to an accessible route of travel is impacted by lateral obstructions, a continuous permanent barrier around or at the base of the obstruction shall be provided.

Eliminating Barriers and Obstacles

Pedestrian access routes shall be continuous and unobstructed. Obstacles and abrupt changes in elevations create barriers for all pedestrians. Curbs, steps, and stairways create barriers for individuals who use wheelchairs and people pushing strollers or carts. Curb ramps allow access for wheeled devices to areas raised and separated by curbs.

EXHIBIT 3.4 *Direct and Indirect Route Examples*

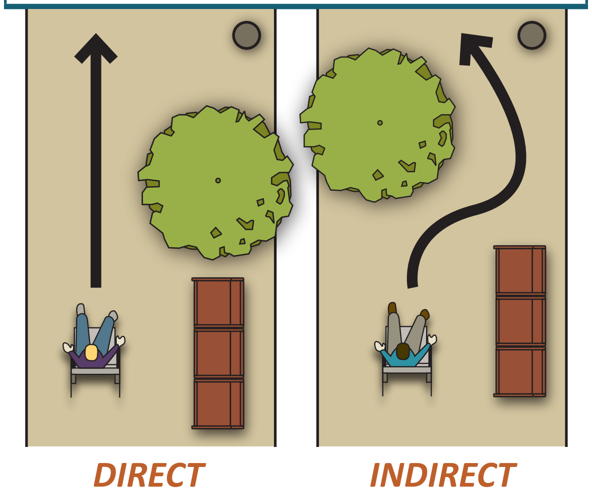
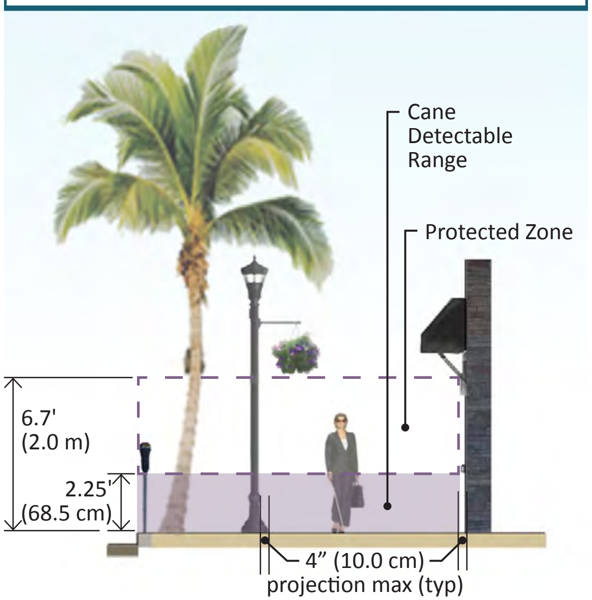


EXHIBIT 3.5 *Obstructions need to be detectable within 2.25' (68.5 cm) of the PAR surface.*



Section R402.2 of PROWAG addresses protrusion limits as follows: *"Objects with leading edges more than 2.25 ft (68.5 cm) and not more than 6.7 ft (2.0 m) above the finish surface or ground shall protrude 4 in (10.0 cm) maximum horizontally into the pedestrian circulation path."* See Exhibit 3.5.

Section 307.5 of ADAAG Required Clear Width: *"Protruding objects shall not reduce the clear width required for accessible routes."*

Coordination between the governing agency, state, city, county, private vendors, utility companies, and others is necessary to avoid placement of obstacles within the pedestrian travel way. Another solution to reducing obstacles is achieved by consolidating elements in a "corral" (such as trash receptacles, newspaper stands, and other street furniture).

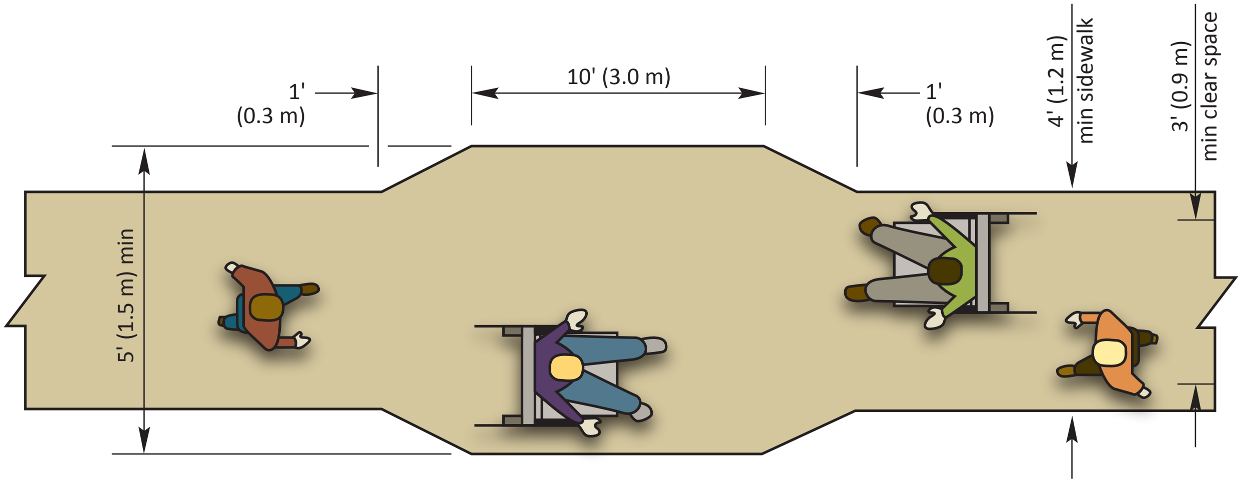
SIDEWALK CAFES

Sidewalk cafes, hanging signs, and displays along a PAR can be hazards for pedestrians with visual impairments and individuals who use wheelchairs or strollers. Enclose cafe areas with railing or fencing to delineate the space from the PAR. Railing/fencing must be detectable by cane to warn visually impaired persons of potential hazards in the path of travel. A continuous uninterrupted railing, fence or barricade meets this requirement if it has a continuous, firm barrier located 27 in (68.5 cm) above ground or lower. If the railing, fence or barricade is not continuous, a detectable barrier must run continuously along the pedestrian side at a height of 27 in (68.5 cm) or less. Provide a clear path of travel around the outside of these areas. Hanging signs should either be placed above the vertical clearance zone or located on posts or light poles outside of the clear width of passage.

Passing Areas

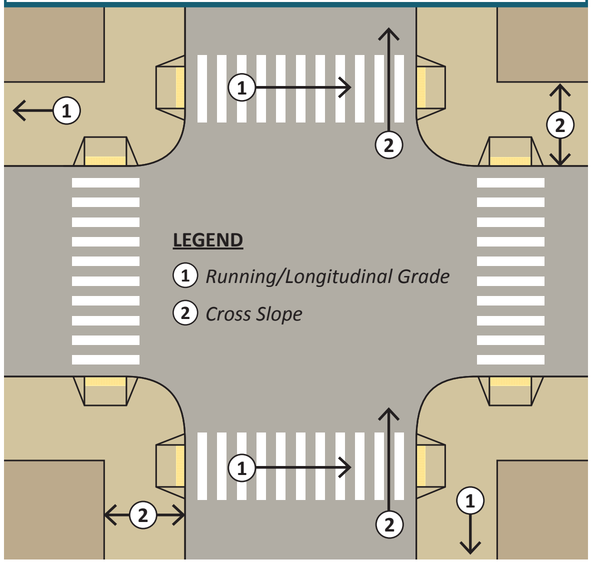
It is necessary to provide sufficient passing areas for two wheelchairs. When an accessible route of travel is less than 5 ft (1.5 m) wide, passing areas that are minimum 5 ft by 5 ft (1.5 m) shall be provided at 200 ft (60.0 m) maximum intervals. A 10 ft (3.0 m) long passing area is preferred. Refer to Exhibit 3.6. Passing areas may already be available at building entrances, plazas, and sidewalk intersections. It is more cost effective, practical, and desirable to create a continuous clear width area wide enough for two wheelchairs to pass each other than to create special passing areas.

EXHIBIT 3.6 *Accessible Passing Area*



Note: Dimensions for passing areas shown are desirable. 5 ft (1.5 m) by 5 ft (1.5 m) is the minimum dimension.

EXHIBIT 3.7 *Running/Longitudinal Grade vs. Cross Slope*



Cross Slopes

Cross slopes on pedestrian surfaces shall not exceed 2 percent. The use of a cross slope less than 2 percent is acceptable, but surfaces should be designed to facilitate positive drainage, avoiding water accumulating on the surface. It is difficult to operate a wheelchair along a route with a cross slope greater than 2 percent because the wheelchair tends to turn toward the direction of the cross slope. As the cross slope of the sidewalk increases, the user is essentially required to steer with one arm and push the wheel with the other arm. This increases the amount of work required to move the wheelchair.

Cross slopes across intersections and crossings also shall not exceed 2 percent, to facilitate crossing by individuals who use wheelchairs and others. Keep in mind this is for the 4 ft wide PAR, and not for the full width of the crosswalk.

Crosswalks

Where provided, crosswalks should comply with the following requirements. Crosswalks should be marked on the roadway with pavement markings. Per HDOT standards, marked crosswalks shall be a minimum of 10 ft (3.0 m) wide. This exceeds the minimum width of 6 ft (1.8 m) recommended by PROWAG, but the 10 ft width is best because it provides more space for pedestrians and greater visibility of the crosswalk. For new construction, the cross slope of pedestrian street crossings, at either marked or unmarked crosswalks, should not be more than 1:48 (2 percent) measured perpendicular to the direction of pedestrian travel. The running grade of pedestrian street crossings, at marked and unmarked crosswalks, shall be no more than 1:20 (5 percent) in the direction of pedestrian travel in the crosswalk.

CROSSING TIME/SIGNAL TIME FOR PEDESTRIANS

Pedestrian crossing intervals shall be calculated as follows:

- A walking speed of up to 4 ft per second may be used to evaluate the sufficiency of the pedestrian clearance time at locations where an extended pushbutton press function has been installed to provide slower pedestrians an opportunity to request and receive a longer pedestrian clearance time.
- The additional time provided by an extended pushbutton press to satisfy pedestrian clearance time needs may be added to either the walk interval or the pedestrian change interval.
- Where pedestrians who walk slower or pedestrians who use wheelchairs routinely use the crosswalk, a walking speed of less than 3.5 feet per second should be considered in determining the pedestrian clearance time.

Designers should also consider extending the time for pedestrian crossings beyond the calculated requirement if any of the following factors exist:

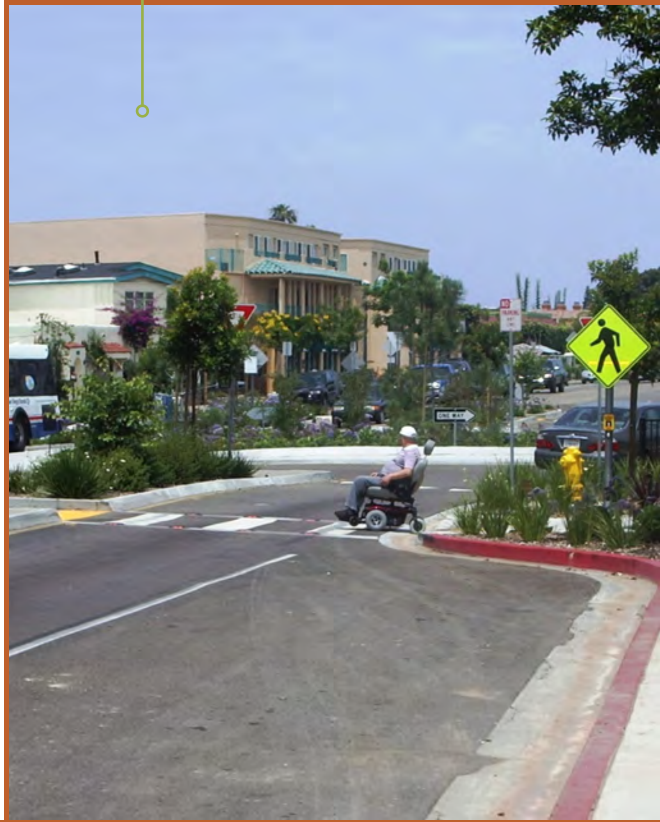
- Running/longitudinal grade of the crosswalk greater than 5 percent
- Cross slope of the crosswalk greater than 2 percent
- Crosswalk length greater than 50 ft (15 m) with no intermediate pedestrian refuge (Keep in mind that retrofit and new designs should comply with maximum 2 percent cross slope and 5 percent running/ longitudinal grade requirements.)

When calculating pedestrian signal phase timing, total crossing distance should include the entire length of the crosswalk plus the length of one curb ramp. Refer to Toolbox Section 5—Intersections and Crossings and the MUTCD for additional guidance.

Medians and Pedestrian Refuge Islands

Raised medians and pedestrian refuge islands in crossings should be cut through at street level or have curb ramps at both sides. Each

Accessible crosswalk with markings, curb extensions, and a median refuge island. (www.streetswiki.wikispaces.com)



Expanding a sidewalk provides space for a curb ramp landing.

curb ramp shall have a level area (landing) 4 ft (1.2 m) square, minimum at the top of the curb ramp in the part of the island intersected by the crossings. Cut-throughs should be aligned perpendicular to the street being crossed and should be parallel to the direction of the pedestrian access route if the pedestrian access route is not perpendicular to the street. Medians and pedestrian refuge islands shall be a minimum 6 ft (1.8 m) minimum in length in the direction of pedestrian travel.

Sidewalk Curb Ramps

Sidewalk curb ramps may also be known as accessible ramps or wheelchair ramps placed at intersection corners, crossings, parking access, and other locations to facilitate a seamless transition from the sidewalk level to the street level.

DESIGN OF SIDEWALK CURB RAMPS

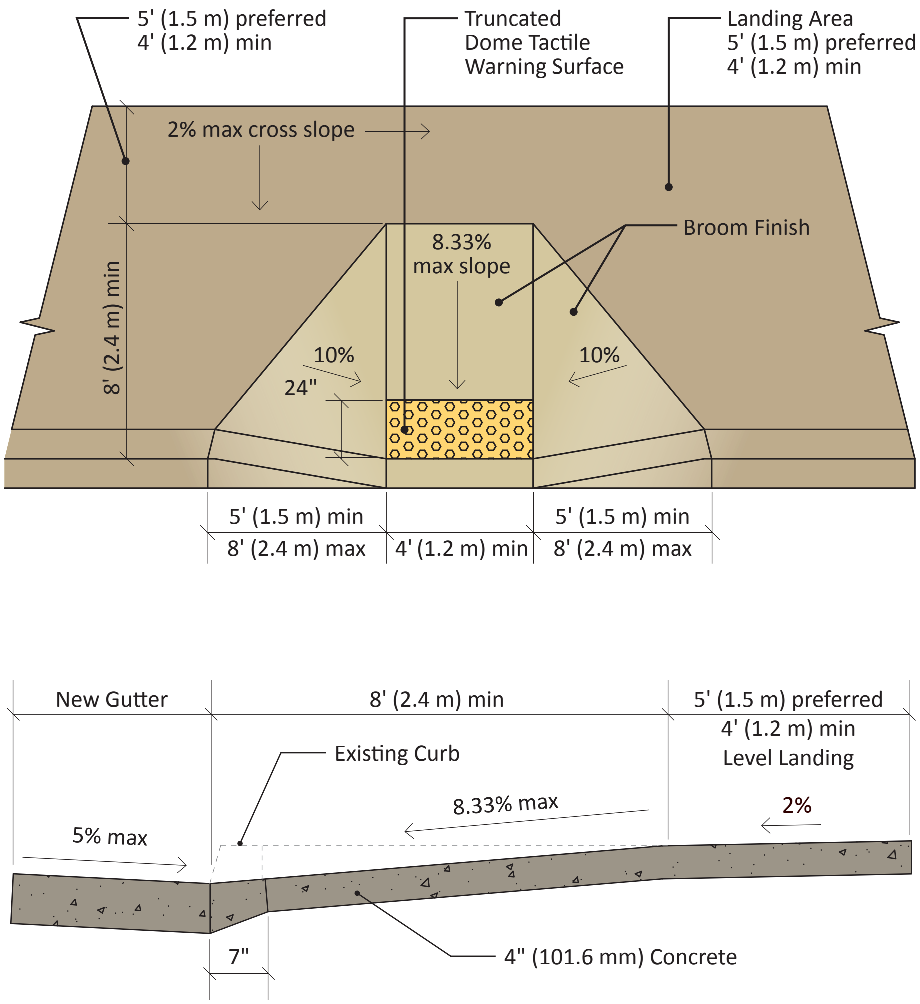
Sidewalk curb ramps provide accessibility at intersections, building entrances, and other areas where elevated walkways are edged with curbing. They must be designed in a standard manner so they are detectable to people with sight impairments and so people in wheelchairs can use them with consistency.

Exhibits 3.8 and 3.9 show methods for curb ramp design in detail.

Even though some sidewalk curb ramp details suggest a minimum ramp length of 6 ft (1.8 m) [6 in (152 mm) curb height at 5 percent], most often the curb ramp uphill slope is running against a sidewalk cross slope of 1 to 2 percent, which makes the curb ramp longer to intersect the sidewalk grade. For example, a curb ramp placed perpendicular to a sidewalk that has 2 percent cross slope would require the curb ramp to be about 7.2 ft (2.2 m) long. In this case, designers may choose to reconstruct the entire sidewalk. HDOT uses an 8 ft (2.4 m) minimum length for Type A curb ramps.

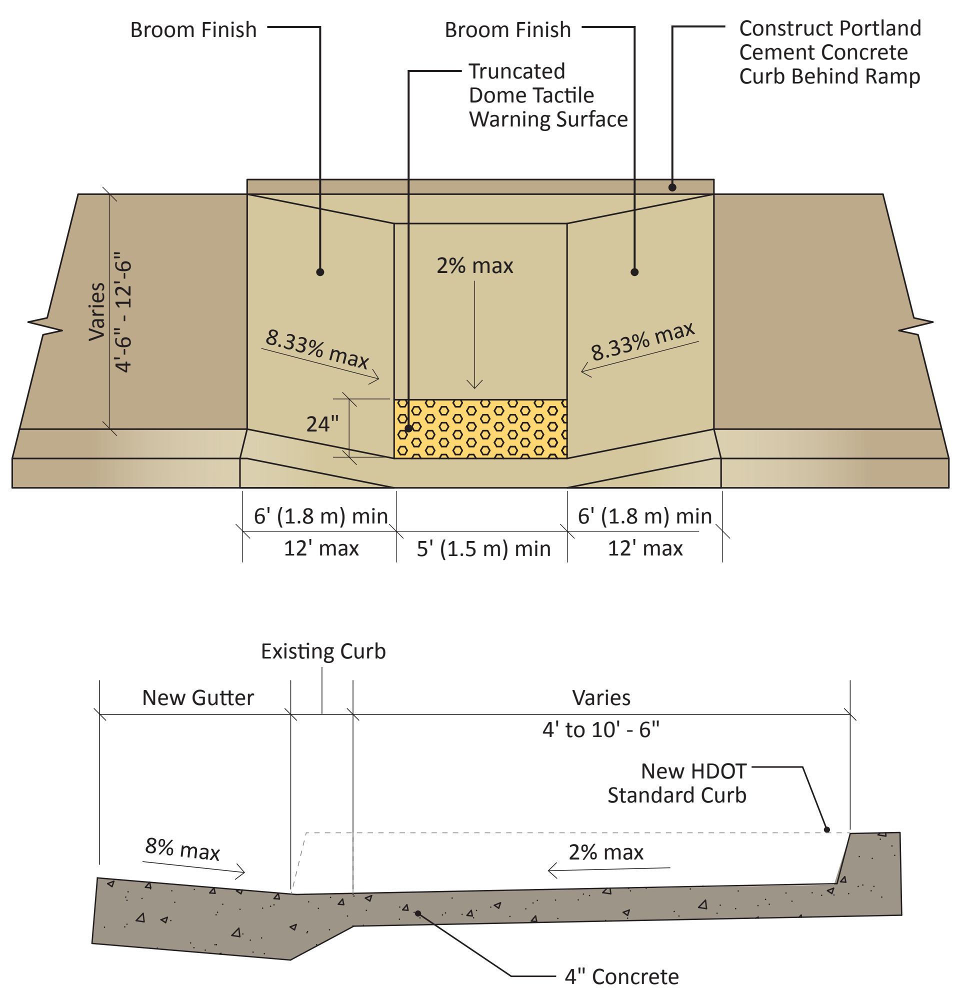
A curb ramp may often be located along an existing sidewalk with a cross slope and running slope that exceed PROWAG guidelines. Rather than referencing a generic standard plan in the design documents, situations like this require detailed engineering design of the curb ramp with dimensions and spot elevations to control the constructed product. HDOT always requires site-specific design of curb ramps due to past problems with contractors referencing

EXHIBIT 3.8 Accessible Curb Ramp Design Details - Type A



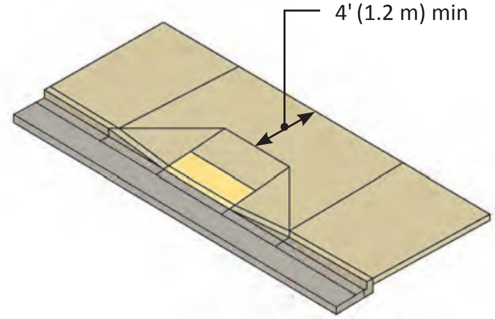
Notes:
1. Ramp and approaches shall be clear of obstacles including hydrants, poles, and inlets.
2. Ramp center line shall be perpendicular to or radial to curb returns unless otherwise approved by engineer.
3. If roadway slope is >2%, conform to roadway slope and file technical feasibility statement.

EXHIBIT 3.9 Accessible Curb Ramp Design Details - Type B



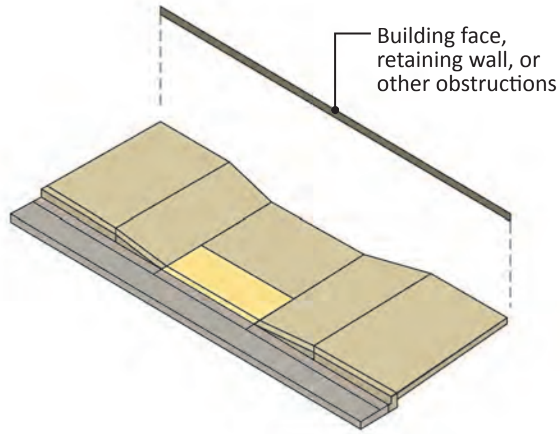
Notes:
1. Ramp and approaches shall be clear of obstacles including hydrants, poles, and inlets.
2. Ramp center line shall be perpendicular to or radial to curb returns unless otherwise approved by engineer.
3. The slope of the ramp shall take precedence over the length of the ramp. If the maximum slope of a ramp cannot be met within a length of 12 ft, then the slope of the ramp shall be set when the length of the ramp is set at the maximum of 12 ft.

EXHIBIT 3.10 Curb Ramp Type A



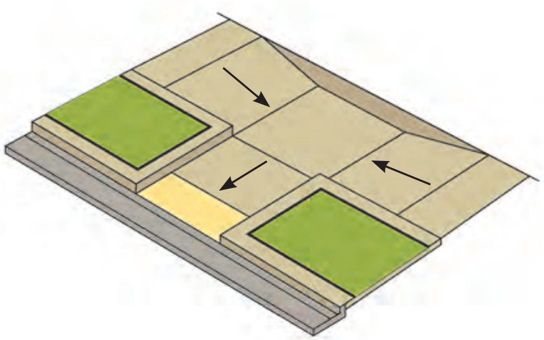
Provide minimum 4 ft landing at top of ramp for turning or bypassing the ramp.

EXHIBIT 3.11 Curb Ramp Type B



Use where inadequate top landing space exists.

EXHIBIT 3.12 Curb Ramp - Alternate Option



If planter width is 6' or greater the slope can be eliminated.

See HDOT standard plans for ramp construction details.

EXHIBIT 3.13 Important Things to Remember about Curb Ramps at Intersections

Curb ramps shall align in the direction of crosswalks, with two per corner at each intersection.
The low end of the curb ramp shall meet the grade of the street with a smooth transition, and no lip.
Curb ramps should also be provided at channelization islands at intersections and median refuge islands, unless full cut-through openings are provided at grade with the street
Good drainage at intersection corners is important so that standing water does not accumulate within the crossing area. Storm drainage inlets should be placed on the uphill side of crosswalks and outside of the crosswalk area.

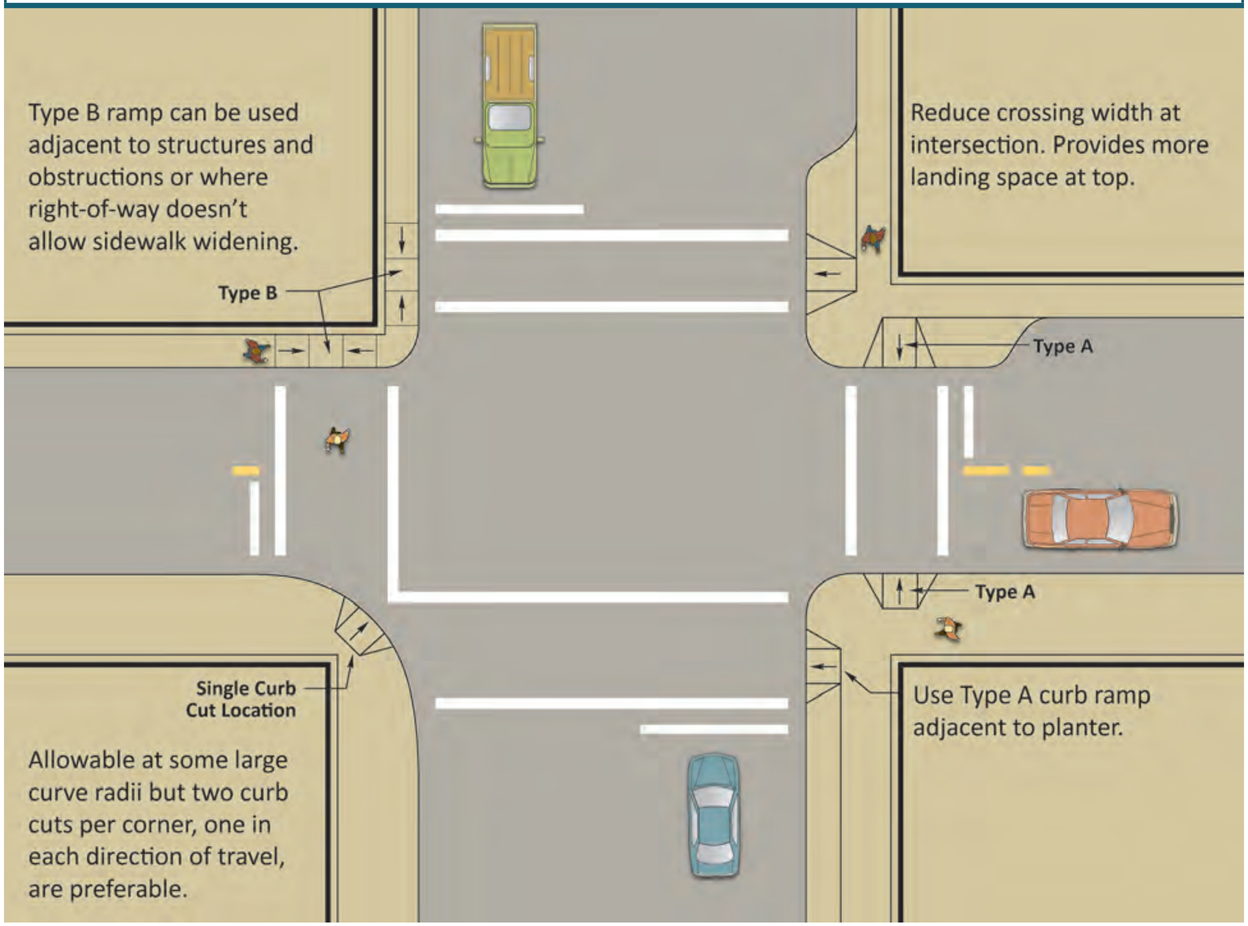
standard plans. Designers should not rely on field inspectors and contractors to lay out these special ramps based only on the standard plan.

LOCATIONS OF SIDEWALK CURB RAMPS AT INTERSECTIONS

Curb ramps are important devices at intersections, not only because they facilitate crossing for individuals who use wheelchairs, people pushing strollers, bicyclists, and others, but also because they can help pedestrians with visual impairments identify the street crossing location and provide directional guidance. Two curb ramps per corner are required for new intersections, one in the direction of each crosswalk (see Exhibit 3.14).

The use of only one curb ramp at each corner (diagonal ramp) may direct pedestrians out into the center of the intersection and into an opposing traffic lane, rather than toward the crosswalk. A single ramp placed on the diagonal of the corner may introduce a pedestrian at a point where drivers are not anticipating a pedestrian, especially when turning. Exhibit 3.13 lists important criteria for the design of curb ramps at intersections.

EXHIBIT 3.14 *Sidewalk Curb Ramps at Intersections*



Detectable Warning Surfaces

People who are blind or have low vision need cues as they travel through a pedestrian system to identify the boundary between a pedestrian route and a vehicular route where there is a flush connection. Detectable warning surfaces can provide this cue. If their meaning is understood, textural changes in the surface of the pedestrian area can serve as a tactile cue for persons who have low vision or are blind. Details of the detectable warning strip and domes are shown in Exhibits 3.15 and 3.16 and PROWAG.

The detectable warning is a unique and standardized surface intended to alert pedestrians who are blind or have low vision to the presence of traffic and hazards in the line of travel and should only be used for this purpose. The truncated dome surface should not be used for wayfinding or directional information. They are strictly for detection of street edges and transit ways (any locations pedestrians may encounter moving traffic). However, detectable warnings are not desirable at driveways because installation at driveways would make it harder to identify the street.

Domes should be aligned on a square or radial grid in the direction of travel. The purpose of

EXHIBIT 3.15 *Detectable Warning Strip Location*

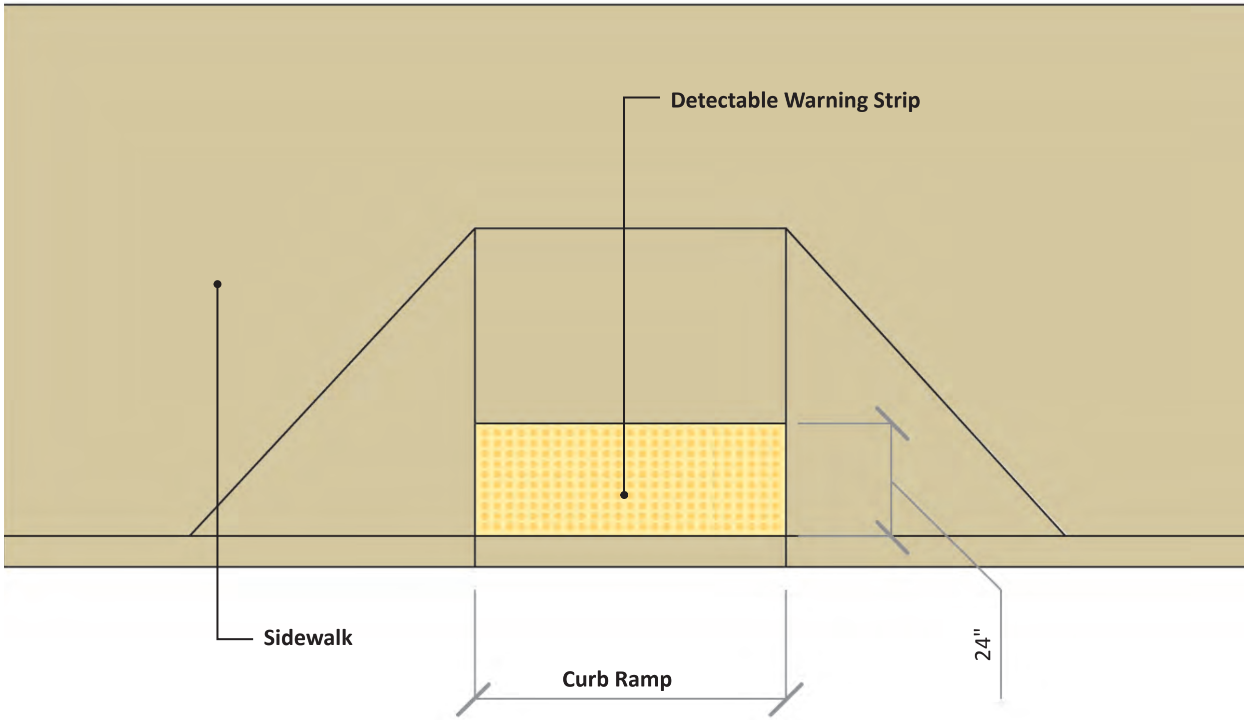
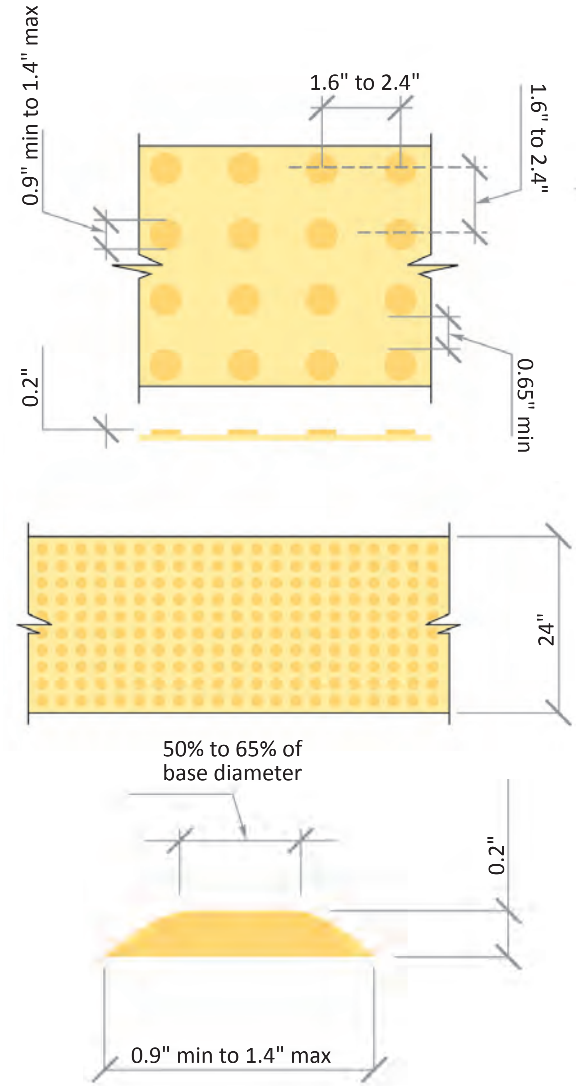


EXHIBIT 3.16 *Detectable Warning Strip Dome Spacing and Dimensions*



this alignment is to permit wheels to roll between domes, and provides the greatest chance for wheelchair wheels to avoid the truncated domes.

Per PROWAG R304.1.4, detectable warning surfaces shall extend 2 ft (610 mm) minimum in the direction of travel and the full width of the curb ramp (exclusive of flares), the landing, or the blended transition. Domes function much like a stop sign for pedestrians who are blind or have low vision, and the 2 ft depth is appropriate to provide the message before stepping into the street.

When a ramp, landing, or blended transition provides access to the street continuously around a corner, the vertical rows (running up from the back of curb) of truncated domes should be aligned to be perpendicular or radial to the grade break between the ramp and the street for a full width for each crosswalk served.

DETECTABLE WARNINGS AT MEDIANS/ISLANDS

Medians and refuge islands that are level with the street at crosswalks and curb ramps shall have detectable warnings provided at the following locations:

- At the base of curb ramps or the outside border of cut through spaces. Note that it is preferable for disabled pedestrians to use cut-throughs than curb ramps in islands.
- At cut-through islands located at the curbline in-line with the face of curb and shall be separated by a 2 ft (61.0 cm) minimum length of walkway without detectable warnings.

VISUAL CONTRAST

Per PROWAG, detectable warning surfaces shall contrast visually with adjacent gutter, street or highway, or walkway surface, either light-on-dark or dark-on-light. Contrast may be provided on the full ramp surface, but should not extend to the flared sides. Many pedestrians use the visual contrast at the toe of the ramp to locate the curb ramp from the other side of the street. The color yellow is often used, but other contrasting colors are acceptable. (See PROWAG.)

Curbs are also important detection devices for people with visual impairments along street edges and intersections. Curbs help individuals who use canes to clearly detect curb ramps and driveways because they can follow the curb line and note where it recesses. The removal of curbs, such as at an intersection where curbs are flush with the street surface, can cause difficulty for those who are blind or visually impaired because they may have trouble detecting the edge of the street. In those places and along the edges of shared streets, where the street level and sidewalk level is the same, detectable warning strips should be provided to delineate the edge of the primary vehicle traffic area.

Rolled curbs also can present detection problems for blind pedestrians. It is recommended that rolled curbs be transitioned to vertical curb or to vertical curb and gutter around intersection curb returns to provide better detection and information to blind pedestrians.

An example of a detectable warning strip located in Portland, Oregon. (Texas DOT)

Detectable warning strips shall be provided at cut-through refuge islands. (www.globalride-sf.org)

A pedestrian waits to feel the vibrotactile walk signal at an intersection. (NCHRP)

Accessible Pedestrian Signals (APS)

According to the MUTCD, an accessible pedestrian signal (APS) is a device that communicates pedestrian timing information in nonvisual formats through audible tones, verbal messages, and/or vibrating surfaces (Section 4E.09).

According to PROWAG, an APS is a device that communicates information about the “Walk" and "Don't Walk" phases in audible and vibrotactile formats (R209.1).

An APS provides audible and tactile cues to pedestrians who may have difficulty seeing the visual cues that typical traffic signal pedestrian features provide. An APS alerts individuals to the existence and location of pedestrian push buttons, tells them the beginning of the walk interval, and helps establish the direction of the crosswalk and location of the destination curb. An APS can also provide intersection street names in Braille or with a speech message, relay intersection signalization with a speech message, and intersection geometry through tactile maps, diagrams, or speech messages. (See Exhibit 3.17 and 3.18.)

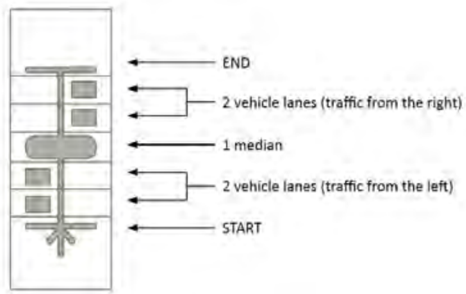
Several benefits occur with the use of an APS. Pedestrians who are blind or have low vision can make better judgments about when to cross, and typically complete their crossings before the signal changes. Another benefit is that sighted pedestrians often make a faster start when the walk indication occurs because of the audible information that comes from the APS.

GUIDELINE REQUIREMENTS

Two documents guide the requirements and installation of APS devices, the MUTCD (2009) and the PROWAG, which sets forth the guidelines per federal mandate. The MUTCD outlines the detailed technical requirements for installation.

PROWAG requires the installation of APS devices for new construction or alterations where pedestrian signals are provided, unless it is technically infeasible, whereby it should be done to the maximum extent feasible. While MUTCD suggests that studies should be performed to determine if APS is warranted, the PROWAG language that requires APS devices is still in the rulemaking stage and when adopted would revise the MUTCD. Because PROWAG is currently being finalized by the US Access Board,

EXHIBIT 3.17 *Tactile Street Crossing Map on an APS-Integrated Push Button Housing*



APS integrated push button unit with tactile street crossing map (NCHRP)

EXHIBIT 3.18 *Speech Messaging (Dan Burden)*

designers should plan to include APS wherever new signals are planned or existing signals are altered.

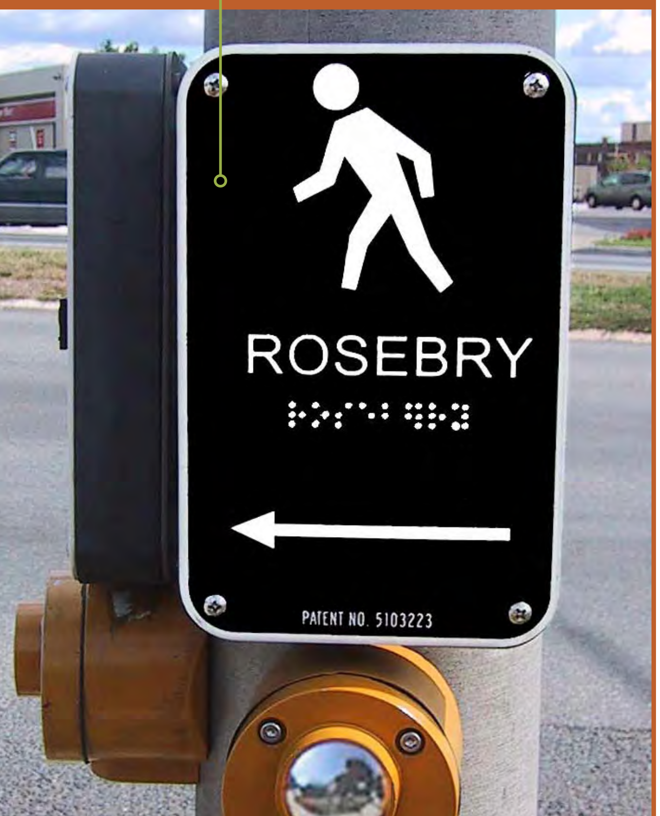
MUTCD Chapter 4E, Section 4E.09 (and beyond) discusses the design and construction requirements of APS elements, as well as technological features.

APS HISTORY

Early installations of APS devices in the US consisted of "cuckoo" and "chirp" or "cheep" sounds mounted on the pedestrian signal head. They were part of the overall installation and did not have a special call feature, so they sounded each time a pedestrian interval occurred. The sound provided some directional guidance to

Speaker mounted above a pedestrian signal (NCHRP)

Braille Street Sign at Pedestrian Signal.



blind pedestrians, but the duration was typically only during the walk interval, silenced during the clearance interval. This resulted in directionality benefits being lost during the clearance interval. They were also controversial because those living near them complained about noise. APS technology has advanced to better solutions.

APS FEATURES

Current technology for APS solves many of the problems created by the older APS installations. Push button-integrated APS features are much more complete, provide information in a more consistent format, and MUTCD now provides a relatively standard approach to designing and installing them. An overall discussion about the features follows.

Locator Tone

A push button locator tone is a repeating sound that informs approaching pedestrians that they are required to push a button to actuate pedestrian timing. This enables pedestrians who have visual disabilities to locate the push button.

Locator tones typically sound from the push button assembly during the DON'T WALK intervals.

A tone is also provided for the WALK interval. Current recommendations are that the tone used to indicate the WALK interval should be a ticking tone which repeats 8 to 10 times per second, otherwise known as the rapid tick. That tone is also provided from the pedestrian push button location. The WALK indication shall have a faster repetition rate (8 to 10 ticks per second) than the push button locator tone (1-second intervals). (MUTCD)

Accessible Pedestrian Signals: A Guide to Best Practices describes locator tone use by pedestrians who are blind or who have low vision as follows.

Pedestrians who are unfamiliar with an intersection will approach the intersection and take the following actions:

- Upon hearing the locator tone or two locator tones if there are two push buttons, they will realize that there is a push button for the crossing.
- They will probably continue to the curb or curb ramp location in order to become familiar with the corner and intersection layout and to determine proper alignment.

This accessible pedestrian signal has a high-contrast, raised tactile arrow on the push button and a high-contrast recessed tactile arrow on the sign above the button.

They will orient themselves to the sounds by listening to traffic.

- They will return to, if they are not already standing next to, the push button locator tone that is believed to be the correct push button for the crossing and check that the tactile arrow alignment is parallel to the desired crosswalk.
- They will push the button and return to the curb to realign themselves for crossing the intersection.
- They may repeat this process if the pedestrian phase begins before they are properly aligned to cross.
- If the push button locator tone for the APS device on the opposite side of the street is audible as they cross the street, they may focus on the sound for verification of alignment.

Automatic Volume Adjustment

Push button-integrated locator tones have the capability to measure the ambient noise levels and will generally self adjust to be 2 to 5 decibels (dB) above the background traffic noise. MUTCD suggests that volume of the slowly repeating tone should be adjusted to be heard no more than 6 to 12 ft (1.8 to 3.6 m) from the push button or at the building line, whichever is less.

Speech Messages

Speech messages from the push button are most important when the push buttons for the two crossing locations at a signalized intersection are less than 10 ft (3 m) apart. (Location of push buttons is discussed later in this section.) Research has found that the locator tone and vibrotactile assemblies are more effective at providing crossing information when the two push buttons are adequately separated, but speech messages are best when the two push buttons are closer together. Drawbacks of speech messages are that pedestrians with hearing loss, who are not fluent in English, or who have cognitive disabilities may have difficulty hearing or understanding the message.

Tactile Arrow

Tactile arrows are used to help pedestrians who are blind or have low vision align with the crosswalk and determine which crosswalk the push button controls. Pedestrian signal devices shall provide tactile and visual signs complying with PROWAG 306.4 on the face of the device or its housing or mounting to indicate crosswalk direction. Signs shall include a tactile arrow aligned parallel to the crosswalk directions. The arrow shall be raised .03 in (.8 mm) minimum and shall be 1.5 in (38 mm) minimum in length. The arrow shall contrast with the background.

Other Features

Often, APS units can include other features that provide useful information to the blind pedestrian. These could include:

- Braille signage – PROWAG requires street name information in Braille or in an audible format. If speech messaging is not used, then Braille signage is required.
- Tactile map – Tactile maps can be helpful to blind pedestrians in understanding the layout of the crossing they are about to make. The information can include curb location (if curb exists), the number and location of lanes (including bike lanes) to be crossed, presence of a median, and parking presence.

Another useful feature that can be provided is the extended button press. If an extended push button is used, a push button press of less than one second shall actuate only the pedestrian timing and any associated accessible walk indication. A push button press of one second or more shall actuate the pedestrian timing, any associated accessible walk indication, and any additional feature(s). This extended press can call up an extended crossing time, a push button information message (most often intersection street name information), and audible beaconing that helps blind pedestrians hone in on the push button at the opposite end of the crosswalk, improving directional interpretation. If additional crossing time is provided by means of an extended push button press, a PUSH BUTTON FOR 2 SECONDS FOR EXTRA CROSSING TIME plaque shall be mounted adjacent to or integral with the pedestrian push button. (MUTCD Section 4E.13)

EXHIBIT 3.19 Example of Adequate Separation Between APS Integrated Push Buttons

INSTALLATION LOCATION

Placement of the push button-integrated APS is critical for accurate understanding by pedestrians who are blind or have low vision.

Placement helps to indicate which street is being crossed, how to line up to cross, and separates audible messaging between the two push buttons controlling the two crossings at a typical intersection. (See Exhibits 3.19, 3.20 and 3.21.) MUTCD location guidance give some important guidance:

- Two push buttons should be used, one for each direction of travel on the same corner, separated by a minimum of 10 ft (3 m). This allows the blind pedestrian to more easily determine which direction of travel each push button serves.
- Having both APS-integrated push buttons on the same pole makes it extremely difficult for pedestrians who are blind or have low vision to determine which push button applies to which crossing. As a result, when two APS-integrated push buttons are closer than 10 ft (3 m), a speech message is required. Per MUTCD, the following features are required if placement separation is less than 10 ft (3 m).
  - — A push button locator tone
  - — A tactile arrow
  - — A speech walk message for the

EXHIBIT 3.20 Ideal Location for APS Integrated Push Buttons (MUTCD)

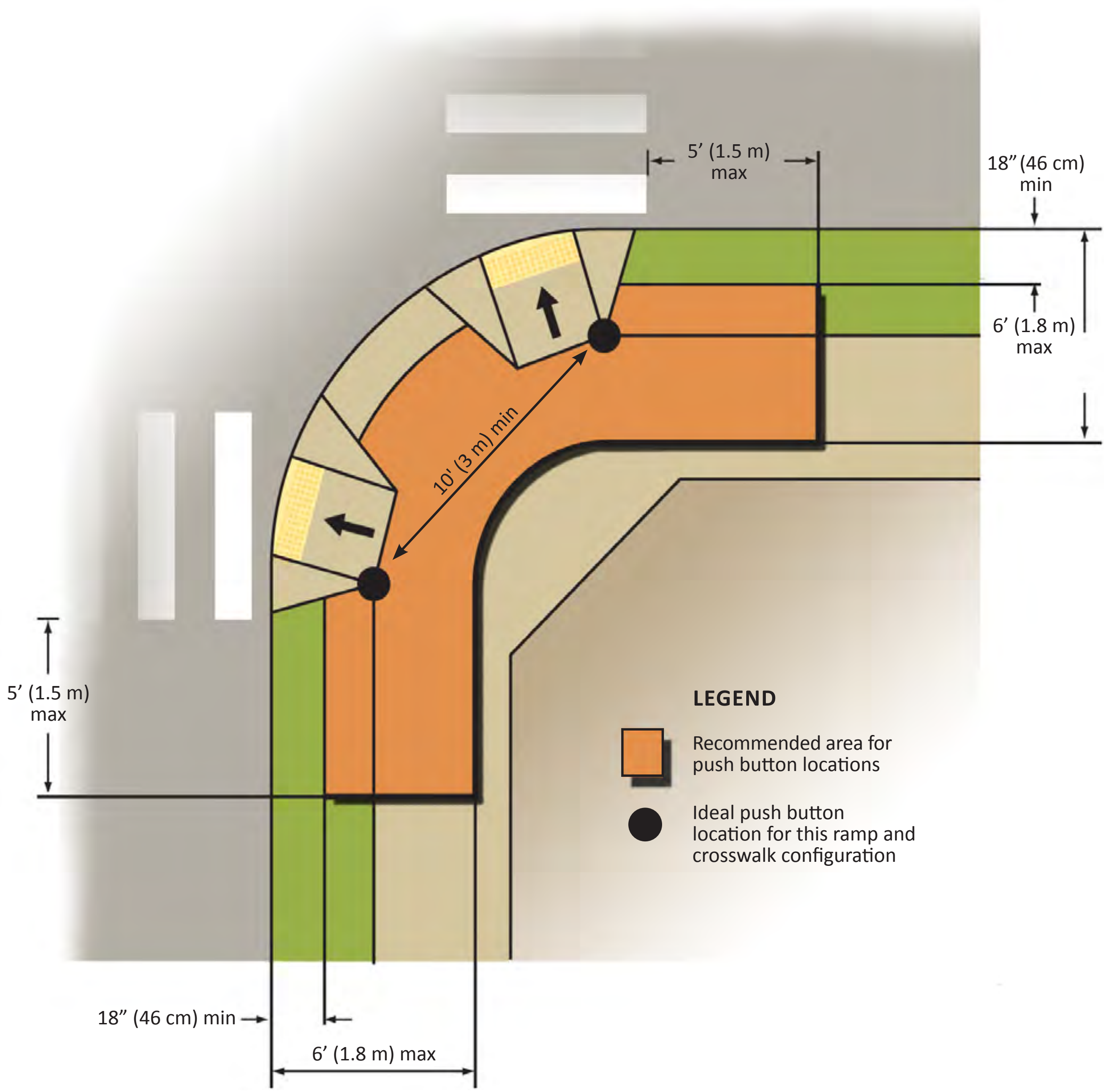
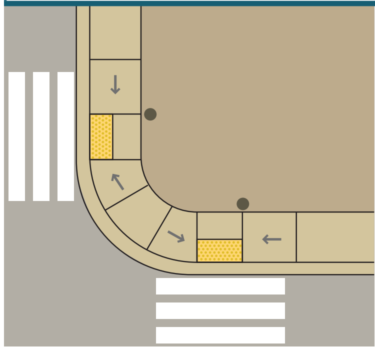
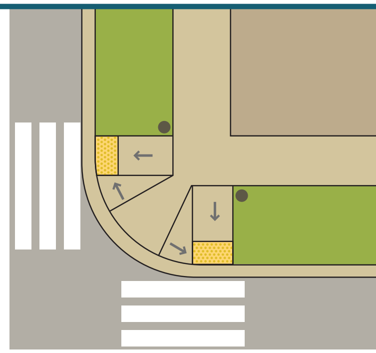


EXHIBIT 3.21 ***Locations for Push Buttons in Various Ramp Configurations***



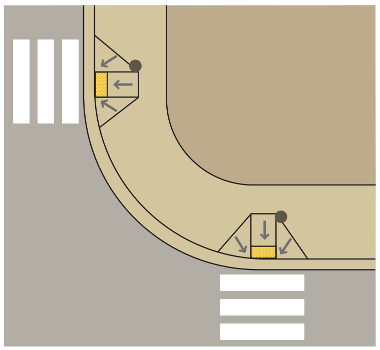
10 ft radius, 5 ft sidewalk,
parallel ramps



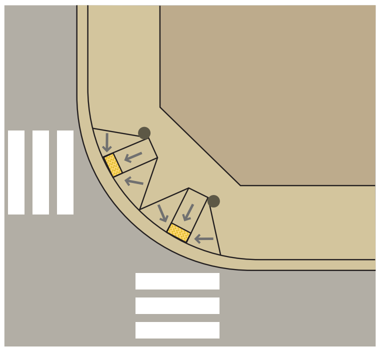
10 ft radius, 5 ft sidewalk with
parkway, perpendicular ramps

LEGEND

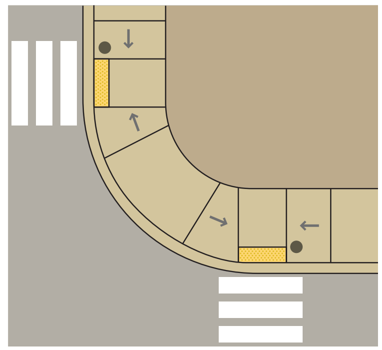
- APS Pole
- Detectable Warning
- Ramp Indication



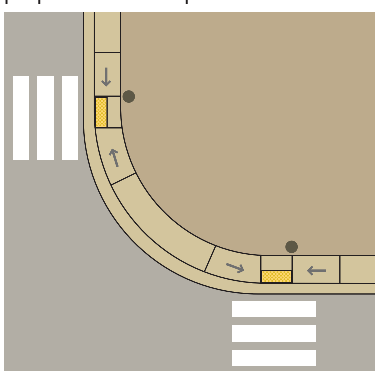
30 ft radius, 12 ft sidewalk,
perpendicular ramps



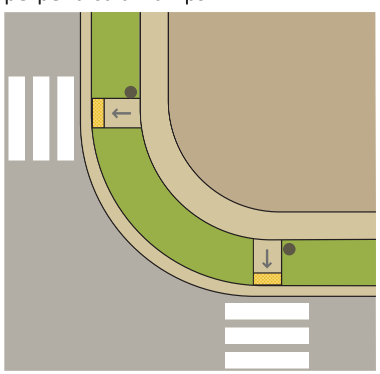
30 ft radius, 12 ft sidewalk,
perpendicular ramps



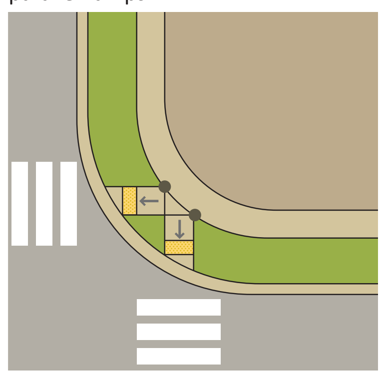
30 ft radius, 12 ft sidewalk,
parallel ramps



30 ft radius, 5 ft sidewalk,
parallel ramps



30 ft radius, 5 ft sidewalk with
parkway, perpendicular ramps



30 ft radius, 5 ft sidewalk
with parkway, perpendicular ramps

EXHIBIT 3.22 ***Push button must be within 5 feet of the extended crosswalk line.***

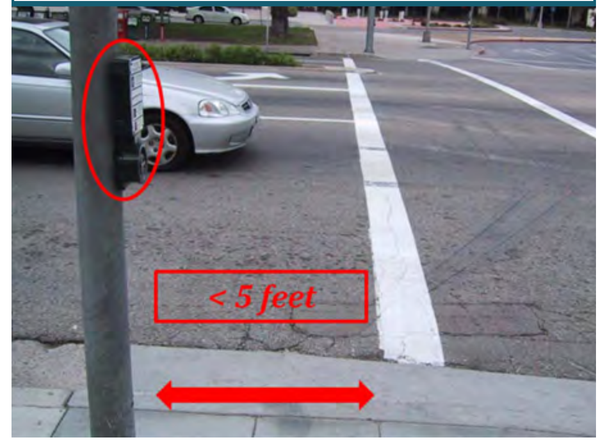


EXHIBIT 3.23 ***Push button must be within 10 feet of curb.***

WALKING PERSON (symbolizing WALK) indication, and

- A speech push button information message

- Per PROWAG, accessible pedestrian signals shall be located so that the vibrotactile feature can be contacted from a clear floor or ground space. (See PROWAG 209.1.)

- MUTCD provides the following guidance:

  A. Unobstructed and adjacent to a level all-weather surface to provide access from a wheelchair

  B. Where there is an all-weather surface, a wheelchair accessible route from the push button to the ramp

  C. Between the edge of the crosswalk line (extended) farthest from the center of the intersection and the side of a curb ramp (if present), but not greater than 5 ft (1.5 m) from said crosswalk line

  D. Between 1.5 and 6 ft (0.5-1.8 m) from the edge of the curb, shoulder, or pavement

  E. With the face of the push button parallel to the crosswalk to be used

  F. At a mounting height of approximately 3.5 ft (1.1 m), but no more than 4 ft (1.2 m), above the sidewalk

Where there are physical constraints that make it impractical to place the pedestrian push button between 1.5 and 6 ft (0.5 and 1.8 m) from the edge of the curb, shoulder, or pavement, it should not be farther than 10 ft (3 m) from the edge of curb, shoulder, or pavement.

Exhibits 3.22 and 3.23 show location examples with notes from *Accessible Pedestrian Signals: a Guide to Best Practices*.

Signage and Other Communication Aids

Signage is an essential aid for all pedestrians, including older adults and people with disabilities. Signage identifies nearby services, warns of possible hazards, and directs people to their destinations. Signs should be readily observable, with clear and precise information.

To provide accessibility in signage, planners and designers need to understand which signage components are important for those requiring accessibility. Street identification, bus route identification, and informational and warning signs provide basic information that pedestrians with visual impairments rely on to guide their mobility.

STREET IDENTIFICATION SIGNAGE

Street identification signage is primarily provided for motorists, and usability by pedestrians is often an afterthought. As a result, the location for many street signs precludes the addition of accessible signage. Also, the lack of consistent locations for sign posts and other elements makes the installation of tactile signage less effective because individuals with visual impairments would not necessarily know where (or even if) those elements are present.

Where an APS is provided, visual and tactile street identification shall be provided above the push button. For additional information, refer to PROWAG, MUTCD, and the Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations. (Exhibit 3.24 shows a page from the Special Report.)

BUS ROUTE IDENTIFICATION

Where bus route identification signs are provided in the public right-of-way on or adjacent to a public sidewalk, visual characters, tactile characters and Braille signs providing the route number and route name should be provided and are required when a bus route identification sign is located at the bus shelter. If a variable message sign is used at a bus stop or shelter, an audible equivalent should be provided. Spider maps in bus stations that show bus routes are very helpful and can be provided.

Bus stops and shelters are covered as transportation facilities in accessibility guidelines adopted by The United States Department of Transportation (USDOT) as part of the Title II regulation (49CFR Parts 27, 37 and 38). Bus route identification signs must comply with specifications for visual characters. The USDOT's ADA regulations do not require tactile signs at bus stops and shelters, but do require that bus stop locations be audibly and visibly announced on the vehicle.

INFORMATIONAL AND WARNING SIGNS

It is important to provide informational and warning signs in the public right-of-way in an accessible format. However, there are very few recognized standards that address providing

EXHIBIT 3.24 *This excerpt from the Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations, shows a design solution example of a ramp and pedestrian button locations.* *(Accessible Public Rights-of-Way Advisory Committee)*

DESIGN SOLUTIONS 4

CONSTRAINT—LIMITED RIGHT-OF-WAY

Lower Sidewalk to Street Surface (Blended Transition)

Problem Statement

Not enough room for landing and curb ramp.

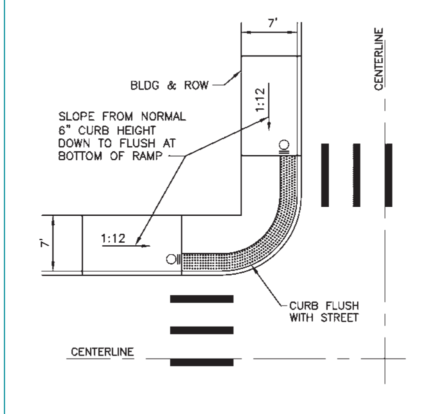
Problem and Design Solution Discussion

Existing street improvements, including vehicle lanes and sidewalks, consume the entire right-of-way. Often there is insufficient space for the installation of an accessible curb ramp and landing at a street intersection that will meet new construction standards. Another potential solution is to lower the sidewalk grade at the intersection to make the sidewalk elevation flush with the street elevation, thus eliminating the spatial needs for curb ramps. Detectable warning surfaces provide a critical message to blind travelers where the sidewalk is flush with the street.

Application Considerations

- Potentially increases construction costs.
- May require street drainage changes/additions.
- Continuous detectable warnings are required to delineate pedestrian area from the street area.
- Placement of APS close to buildings and other hard vertical surfaces creates directional sound interpretation issues for blind pedestrians and should be avoided.
- If provided, bollards should have high visual contrast to background (dark/light or light/dark).

Design Solution 1.05



Related Design Standards

- MUTCD
- Local Codes and Standards

Related Design Guidelines

- AASHTO
- PROWAG

Special Report: Accessible Public Rights-of-Way—Planning and Designing for Alterations

41

information readily accessible to individuals who are blind or have low vision. Signs at construction barriers are of particular concern. Additional discussion about signage for construction activities is provided in Toolbox Section 11—Safety in Work Zones and Maintenance.

TACTILE INFORMATION AND SIGN MOUNTING LOCATIONS

Per PROWAG R409.4.1, tactile characters on signs shall be located 4 ft (1.2 m) above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 5 ft (1.5 m) maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.

Bus shelter signs should be mounted on the shelter wall closest to the front of the bus, as close to the street as possible, at 5 ft (1.5 m) above the adjacent clear landing. Bus stop signage where no shelter is present shall be mounted on the pole at 5 ft (1.5 m) above adjacent grade.

VARIABLE MESSAGE SIGNS

Variable message signs presented using LED, LCD, flip-dot or other means should be legible from the same distance as conventional print signs. Character height for variable message signs should be about 35 percent greater than character height for conventional print signs in order to have equal legibility at the same distance.

AUDIBLE SIGNS

Audible signs are required when visual equivalent signs are provided at the same location. PROWAG extensively discusses standards for frequency, power, range, and other technical requirements for Remote Infrared Audible Sign (RIAS) receivers. Transit stations and platforms are routinely used by persons who are blind or have low vision. Tactile signs do not necessarily help blind people locate station entrances and exits, fare gates, fare machines, stairs and escalators, platforms, and other amenities, because they cannot be located consistently enough for persons who are blind or have low vision to find them efficiently. RIAS receivers are suggested as a wayfinding system because they enable individuals to scan the environment (using a personal receiver) and “read messages” from a distance. They provide directional and informational messages in a way that enables persons who are blind or have low vision to travel as independently as persons who can read print signs.

Accessibility Across Driveways

As a general rule, it is best to minimize the number of driveways a pedestrian must cross. Where a driveway crosses a sidewalk, the driveway must conform in width, cross slope and grade to the design requirements for sidewalks in order to maintain accessibility for pedestrians with disabilities. Unramped curb returns are not permitted. Wheelchairs, strollers, and those who use walkers need a relatively flat surface to travel. Side flares and cross slopes at driveway aprons may cause a drive wheel, caster, or leg tip to lose contact with the surface.

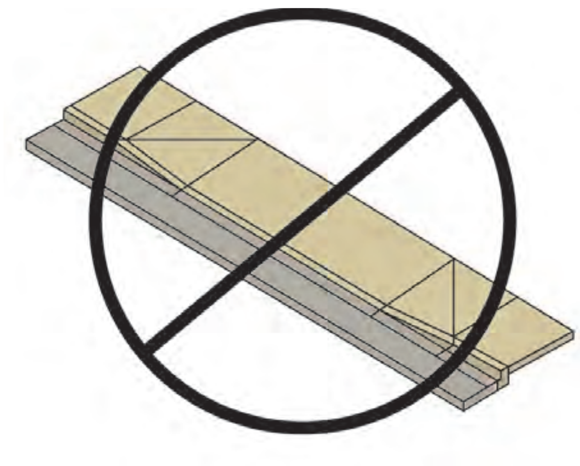
The basic approaches to designing driveway cuts that fulfill accessibility needs are illustrated in Exhibits 3.27 through 3.30. Exhibit 3.26 shows the older type of driveway design that is not ADA-compliant. The important common element of these solutions is that they provide a continuous, level accessible route that is a minimum of 4 ft (1.2 m) in width [5 ft (1.5 m) is desirable] with a cross slope not exceeding 2 percent. Again, keep in mind that this is the minimum width of the clear travel way and not the recommended width of the sidewalk. The full width of the sidewalk will generally be wider. Refer to Toolbox Section 4—Sidewalks and Walkways for sidewalk width recommendations.

Where a parking garage exit crosses a sidewalk, exiting drivers should be reminded that they need to yield to pedestrians. This can be accomplished with Stop or Yield signs and can be supplemented with mirrors, displays, audible signals, and/or flashing lights. Such signs and signals should be directed to the drivers, not the pedestrians. Sufficient sight distance for drivers to see pedestrians at such locations is needed.

EXHIBIT 3.25 ***An existing driveway apron has been reconstructed to provide a level pedestrian route across it.***

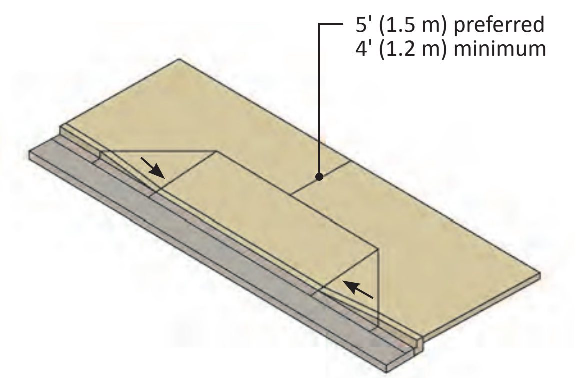
EXHIBIT 3.26 ***Past Driveway Design Example***

NOT ACCEPTABLE



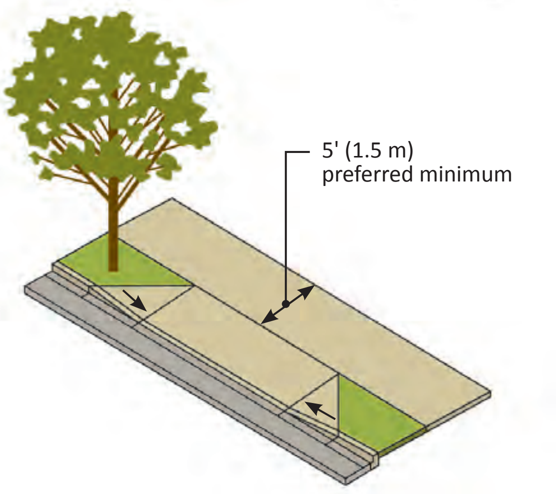
Driveway aprons, traditionally designed like the example above, are difficult to maneuver across due to excessive cross slopes.

EXHIBIT 3.27 Driveway with Wide Sidewalks



Wide sidewalks allow a 5-foot-wide preferred and 4-foot-wide minimum path of travel behind the driveway cut.

EXHIBIT 3.30 Driveway with Planting Strips



Planting strips allow the sidewalk to remain level and in a continuous direction.

EXHIBIT 3.28 Driveway with Sidewalk Behind

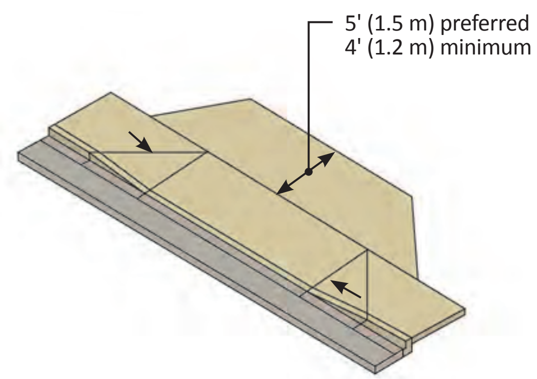
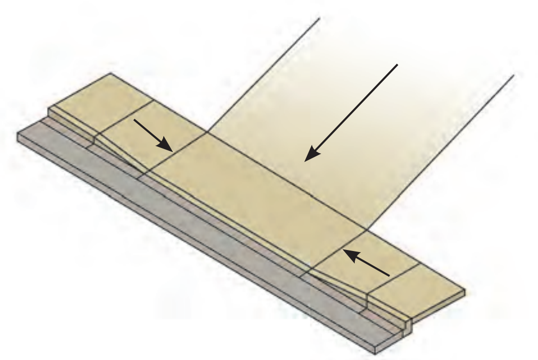


EXHIBIT 3.30 Driveway with Dipped Sidewalk



Site Pedestrian Facilities

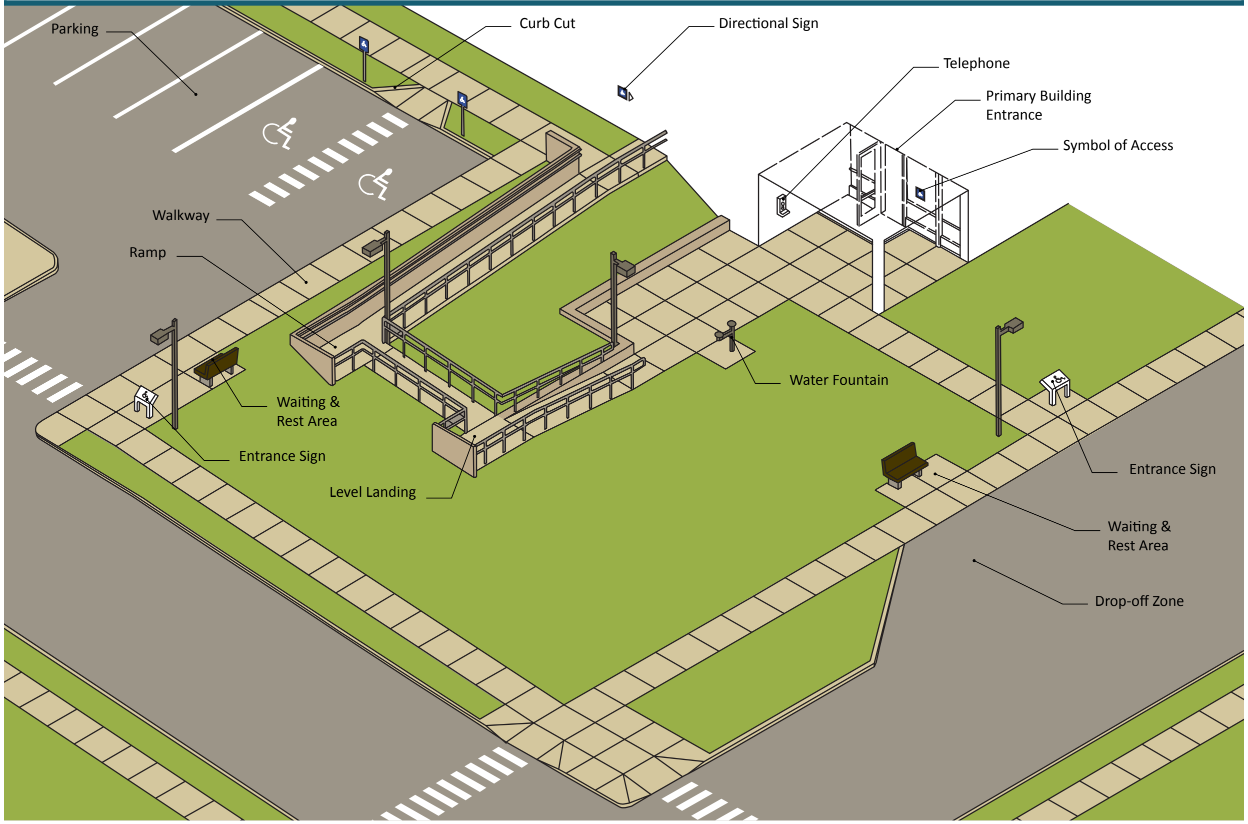
Following are some additional accessibility requirements and guidelines that apply to sites outside of public rights-of-way. This toolbox section highlights some important guidance, but site designers and architects also should refer to ADAAG and the International Building Code (IBC) for more detailed guidance, as well as other guidance related to site design.

Accessible Routes of Travel

Accessible routes of travel are called Accessible Routes (AR) for site development and are defined by ADAAG. ADAAG requires that every site have at least one AR that provides a connection between exterior accessible site elements (parking, waiting and drop-off zones, sidewalks and walkways, bus stops, etc.) and an accessible building entrance. In a park or open space, public facilities and points of interest should be connected by an accessible route. Refer to earlier discussion in this section pertaining to grade requirements for access routes. Exhibit 3.31 illustrates a site with alternative routes of travel connecting the building entrance.

A well designed accessible ramp with handrails at the University of Wisconsin (www.flickr.com/LSNews)

EXHIBIT 3.31 Accessible Site Design (Accessibility Design for All)



Site Connections

The route between accessible parking spaces and the building entrance must be carefully planned to minimize the travel distance for a disabled person and to avoid obstacles and hazards. The maximum distance should be no greater than 100 ft (30.5 m).

Ramps

Providing accessibility along walkways and across sites with significant changes in elevation is sometimes challenging. A ramp is defined as any part of the AR that exceeds a 1:20 grade. Ramps allow accessibility where grades exceed 1:20 or 5 percent.

In general, ramp design shall incorporate the following:

- Maximum running/longitudinal grade of 1:12 or 8.33 percent
- Minimum width of 3 ft (91.0 cm) [5 ft (1.5 m) desirable] for exterior ramps, with a minimum clear space of 3 ft (91.0 cm) between handrails (minimum width of 4 to 5 ft (1.2 to 1.5 m) is desirable where feasible)
- Level landings at the top and bottom of the ramp and at changes in direction
- Intermediate landings for every 30 in (76. cm) of vertical elevation change; every 30 ft (9.0 m) of an 8.33 percent run (see Exhibit 3.33)
- Handrails for walkways and pathways steeper than 1:20
- Maximum cross slope of 2 percent and sufficient to provide positive drainage
- Edge protection on each side of ramp runs and at each side of ramp landings

LANDINGS ON RAMPS

- Where a ramp changes direction, landings shall be 5 ft (1.5 m) wide by 5 ft (1.5 m) long minimum. For this reason, a constant ramp width of minimum 5 ft (1.5 m) would be easier to construct.
- In some cases it may be more practical to design a pathway at a lower gradient to minimize the number of landings required.

EXCEPTIONS TO MAXIMUM GRADES OF RAMPS

- A slope not greater than 1:10 (10 percent) is allowed for a maximum rise of 6 in (150 mm).
- A slope not greater than 1:8 (12.5 percent) is allowed for a maximum rise of 3 in (80 mm).
- Keep in mind that grades steeper than 1:8 (12.5 percent) are difficult to maneuver.

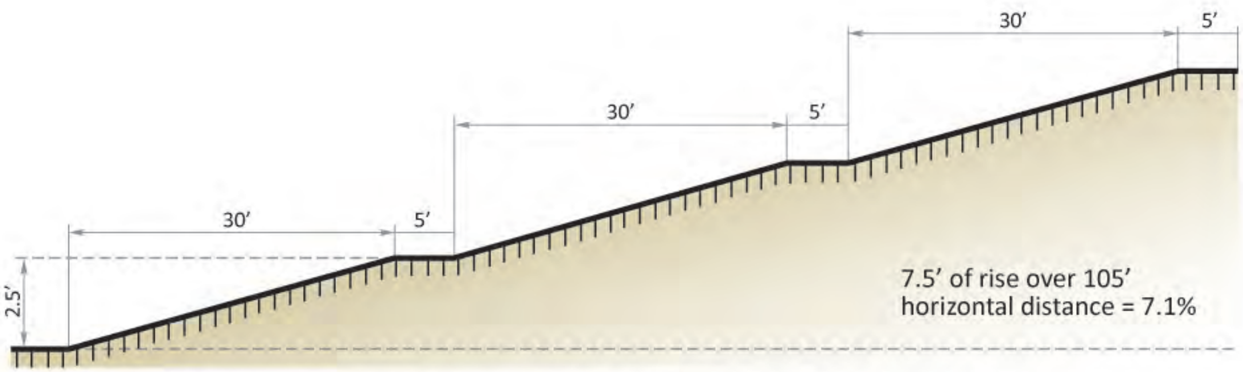
Handrails

Accessible routes (AR) having grades steeper than 1:20 (5 percent) must have handrails on both sides. Handrails shall extend horizontally at least 12 in (305 mm) beyond the top and bottom of any ramp run (see Exhibit 3.34). The top of the handrail is required to be 34 to 38 in (860 to 970 mm) above the grade of the walkway or ramp. An intermediate handrail may be mounted at a height of 16 to 18 in (410 to

EXHIBIT 3.32 Summary of Requirements for Access Routes

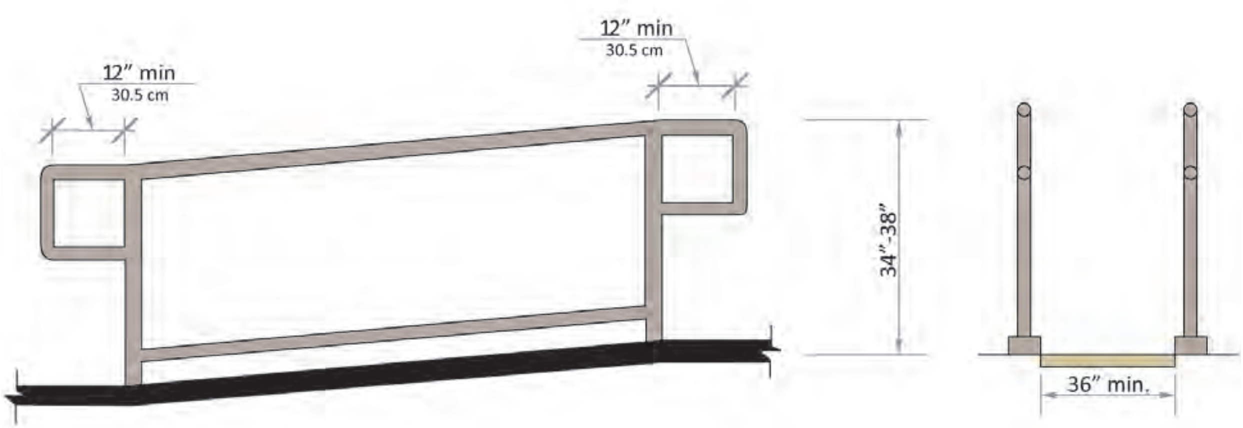
Eliminate obstacles within the access route.
3 ft (91 cm) clear width absolute minimum
5 ft (1.5 m) wide passing areas every 200 ft (60 m) on accessible routes less than 5 ft (1.5 m) in width.
Maximum 1:20 (5%) grade is desirable, steeper grades up to 1:12 (8.33%) can be used for ramps.
Level landing areas, 5 ft (1.5 m) in length, for every 2.5 ft (760 mm) of elevation change along 1:12 (8.33%) grade (ramps).

EXHIBIT 3.33 *Accessible Ramp Pathway with Landings* (Oregon Bicycle and Pedestrian Plan)



Note: If designing an accessible route of travel, handrails are required on both sides of ramps.

EXHIBIT 3.34 *Handrail Detail* (ADAAG)



460 mm) or a handrail with vertical rail members spaced not more than 4 in (100 mm) apart to aid those in wheelchairs.

Handrails are required to be continuous unless there is a point of access along the ramp that requires a break in the handrail.

Handrails should be continuous through the landings for the entire length of the ramp system.

Handrails are not required for sidewalk curb ramps, and are generally not recommended alongside multi-use pathways since they could become a hazard to bicyclists (unless pathway is specifically designated as an accessible route of travel).

Lighting

Lighting is required along exterior accessible routes of travel any time the buildings on site are occupied. A minimum intensity of 1 foot-candle is required on the surface of the route.

Recreational Facilities

Recreational facilities and trails should provide accessible experiences as well. The US Access

Board is developing the Accessibility Guidelines for Outdoor Developed Areas (ODAAG) that will clarify how, and to what extent, access can be achieved. The guidelines will cover new or altered trails, beaches, and picnic and camping areas. Under this rulemaking, the Board is first developing guidelines for outdoor developed areas managed by the Federal government. Guidelines for non-Federal sites will be developed separately under a subsequent rulemaking. On June 20, 2007, the Board released proposed guidelines for recreation facilities managed by the Federal government. Proposed guidelines for non-Federal sites will be published for comment at a future date.

If exceptions outlined in ODAAG 1019 do not allow for the trail to serve as an accessible route of travel, alternate connections can be created that provide a similar recreation experience. If this is not technically feasible, alternate program access can provide a similar experience for disabled pedestrians. For example, an accessible location featuring interpretive descriptions of the trail experience, such as noting viewpoints, with panels that show the view and describe the significance of the trail features.

Other Resources

Refer to the following sources of information for additional guidance.

- American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Planning, Design and Operation of Pedestrian Facilities.* 2004.
- Federal Highway Administration. Kirschbaum, J.B., Axelson, P.W., Longmuir, P.E., Mispagel, K.M., Stein, J.A., and Yamada, D.A. *Designing Sidewalks and Trails for Access, Parts I and II.* 1999. Chapter 7 covers curb ramps. ***http://www.fhwa.dot.gov/environment/sidewalk2/index.htm*** (May 2013).
- Federal Highway Administration. Resource Library. ***http://www.fhwa.dot.gov/accessibility/index.cfm*** (May 2013).
- Institute of Transportation Engineers. *Promoting Sustainable Transportation through Site Design: An ITE Recommended Practice.* 2010.
- Public Rights-of-Way Access Advisory Committee (PROWAAC) to the US Access Board. Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations. ***http://www.access-board.gov/prowac/alterations/guide.htm*** (May 2013).
- US Access Board. *ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).* ***http://www.access-board.gov/adaag/html/adaag.htm*** (May 2013).
- US Access Board. Common Problems Arising in the Installation of Accessible Pedestrian Signals. ***http://www.access-board.gov/research/pedestrian-signals/bulletin.htm*** (May 2013).
- US Access Board *Public Rights-of-Way Accessibility Guidelines (PROWAG).* Draft-rulemaking in process. ***http://www.access-board.gov/prowac/*** (May 2013).
- US Access Board. Sidewalk videos. ***http://www.access-board.gov/news/sidewalk-videos.htm*** (May 2013).
- US Architectural and Transportation Barriers Compliance Board: *Accessible Rights-of-Way: A Design Guide.* 1999.

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TOOLBOX SECTION 4

Sidewalks and Walkways

A wider sidewalk in a shopping area at Waikiki provides more space for pedestrians and creates an attractive walking environment.

SIDEWALKS AND WALKWAYS

Pedestrian facilities addressed in this toolbox section include those located within street rights-of-way that are primarily adjacent to or parallel with the roadway, such as sidewalks, walkways, and roadside spaces used for pedestrian travel.

Sidewalks and Walkways Defined

Sidewalks and walkways are integral components of streets and roadways where pedestrians need to experience safety, comfort, accessibility, and efficient mobility. Sidewalks and walkways increase pedestrian safety by separating pedestrians from vehicle traffic vertically (raised with a curb) and/or horizontally if space is available.

A sidewalk is the space within the right-of-way dedicated to pedestrian travel. Hawaii State Statutes define a "sidewalk" as *that portion of a street between the curb lines, or the lateral lines of a roadway, and the adjacent property lines, intended for use of pedestrians* (Hawaii Revised Statutes 291C-1).

The term "walkway" is often used synonymously with "sidewalk." It is common for sidewalks to be thought of as the paved (typically portland cement concrete) surfaces along a road or street that are raised from the street level and separated by a curb, and they are often constructed to formal standards and drawings. Whereas walkways are often thought to encompass a broader range of either raised or at-grade improved paths for exclusive use by pedestrians.

Sidewalks and walkways provide places for physical activity and recreation.

IN THIS SECTION

Shops and markets attract high levels of pedestrian activity.

PRIORITIES FOR PEDESTRIANS TRAVELING ALONG STREETS

- *Efficient mobility – the route takes people to and from their destinations*
- *Safety and security*
- *Defined space*
- *Visibility between motorists and pedestrians*
- *Accessibility – a firm, stable surface and clear path of travel*
- *A comfortable and attractive environment*

Paved walkways are sometimes used in lower density areas, such as with cluster development or larger lot sizes along roads without curbs or sidewalks. Paved walkways are typically separated from the roadway.

Pedestrian paths that are unpaved and unimproved may be referred to as foot paths or trails. Pedestrian paths that are shared with bicyclists and typically paved are formally called “shared use paths." See Toolbox Section 7 for more information on shared use paths and trails.

In some areas, when no sidewalks, walkways, or shared use paths are available, pedestrians might be seen walking on roadside shoulders. Unpaved foot paths or trails may form as a result of repeated pedestrian traffic. But shoulders and foot paths/trails are not formally recognized as pedestrian facilities. If pedestrians are present or if they potentially could be present, sidewalks, walkways, or shared use paths should be considered to accommodate their travel.

Determining When and Where Sidewalks and Walkways are Needed

Studies have shown that pedestrian travel increases in areas where more pedestrian facilities are available. Higher numbers of pedestrians can be found in areas where more complete and continuous sidewalks, walkways, crossings, and other pedestrian facilities exist.

Sidewalks and walkways separated from the roadway contribute greatly to pedestrian safety. Pedestrians walking along the road account for 10-15 percent of pedestrian crashes nationally. The majority of these crashes happen along high speed roads in rural areas, because urban areas are typically designed for pedestrians. Sidewalks and separated walkways can prevent crashes. Based on the crash reduction factor (CRF), paved shoulders have a CRF of 70 percent and sidewalks have a CRF of 88 percent. (Federal Highway Administration Pedestrian and Bicycle Information Center)

Given these and other research findings, as well as state and federal initiatives to increase and encourage pedestrian travel, there is a general need to provide more pedestrian facilities and improve existing facilities in our communities. In Hawaii, the Statewide Pedestrian Master Plan has documented the need for various pedestrian projects specific to state facilities. Exhibit 4.1 lists various types of technical analyses that can be conducted to determine the need for pedestrian facilities. Other general considerations are summarized below.

Local jurisdictions can prioritize pedestrian projects based on context and land use. For example, locations where the mix and density of land uses results in more pedestrian activity may need improvements before other areas. Major pedestrian generators include (but are not limited to) schools, hospitals, open space, shopping districts, tourist destinations, and senior centers.

Funding sources are not always available to complete large projects at once, causing the retrofitting of pedestrian facilities along existing streets, roadways, and highways to be implemented over time.

To reach the overall goal of a more complete pedestrian travel network, local agencies often

EXHIBIT 4.1 ***Technical Analyses to Determine Pedestrian Improvement Needs***

Context/land use analyses
Walkability audits
Connectivity analyses
Roadway and traffic control device inventories
Sight distance studies
The adequacy of gaps in the stream of traffic for pedestrian crossings analyses
Crash summaries and diagrams
Conflict analyses
Pedestrian volumes and characteristics analyses
Collection of volumes/counts
Speed spot studies

Roads with sidewalks on only one side greatly constrict pedestrian movement.

Pedestrians make good use of limited space in Paia town, Maui

require pedestrian facilities to be constructed as part of private development projects. State and local agencies can then fill in missing links in the network through public funding and capital investment projects. Determining when and where pedestrian facilities are needed is often left up to local jurisdictions. When the needs are great, prioritizing where pedestrian facilities should be constructed, widened, extended, and repaired can be challenging.

The need to improve safety can be a strong factor in determining when and where sidewalk improvements should be made. Analysis of the specific context, including land uses and the transportation network, can help determine pedestrian safety needs. Various types of technical studies can be conducted to further analyze where problems and barriers occur and to identify the types of improvements needed to address these. Exhibit 4.2 lists recommended sidewalk and walkway locations based on land use.

A Policy on Geometric Design of Highways and Streets, by the American Association of State Highway and Transportation Officials (AASHTO) also provides guidance to help determine when and where to provide pedestrian facilities. These recommendations as well as additional suggestions are summarized below.

- Consider the need for pedestrian facilities as part of all street and roadway projects.
- In areas where pedestrian activity exists or is anticipated, pedestrian facilities should be provided.
- Give consideration to connecting nearby urban communities with pedestrian facilities, even though current pedestrian traffic may be light. (The existing level/volume of pedestrian traffic is not an accurate determinant of the future potential level/volume of pedestrian use.) In the future, with growth and development, there will be an even stronger need for pedestrian connectivity between communities.
- Pedestrian facilities are often needed in rural and suburban areas to provide access to schools, parks, community centers, local businesses, employment centers, transit stops and stations, and residential areas.

EXHIBIT 4.2 ***Recommended Sidewalk/Walkway Locations Based on Land Use***

LOCATIONS	RECOMMENDATION
Commercial centers, downtowns, town/village centers, and high to medium density residential areas	Both sides of all streets and roadways
Low-density residential (1-4 units/ac.)	Preferably on both sides, but at least one side with sufficient shoulder width* on the other side
Rural residential (less than 1 unit/ac.)	Preferably on at least one side with sufficient shoulder width* on other side
Areas near schools, parks, community centers, senior housing, hospitals, employment centers, and other pedestrian generating land uses	Both sides of all streets and roadways
Areas with higher exposure risk, such as with higher incidence of collisions/speeding	Review on a case-by-case basis. May require more improvements than standard approach.

** See pages 4-12 and 4-13 for recommended shoulder widths*

As a general best practice, Complete Street principles should be considered on all streets, roadways, and highways in Hawaii.

- Pedestrian warrants for sidewalks along highways have not been established. In general, whenever the roadside and land development conditions are such that pedestrians may travel along a highway, they should be furnished with a sidewalk, walkway or shared use path, as suitable given the conditions.
- The higher speeds of traffic and the absence of consistent lighting in rural areas reinforce the need for separated pedestrian facilities. Studies show that providing pedestrian facilities in rural areas reduces pedestrian/motor vehicle crashes.

When considering the need for pedestrian facilities in rural areas, clear zone requirements need to be evaluated, along with crash data and pedestrian demand. To address both the goal of having safe places to walk and that of the community to retain a rural atmosphere, pedestrian facilities can be developed that do not look like traditional sidewalks, but do meet walking needs. More rural and natural looking walkways may include separated asphalt or compacted crushed stone paths, for example. Even in rural areas, people want and need to walk, and as such facilities should be provided.

Sometimes, natural paths or desire lines are created as a result of frequent travel at the side of the roadway. These paths may suggest the need for more formal pedestrian improvements.

AASHTO has developed levels of service to quantify the relative mobility of pedestrians and conflicts with other pedestrians that influence walking speed, maneuvering room, and the feeling of comfort. Levels of service (A to F, see Exhibit 4.3) reflect increasing crowding and decreasing freedom of movement. The levels of service are based on the available area per person. (For more information, refer to the Walkway Capacities section within Chapter 2

EXHIBIT 4.3 AASHTO Sidewalk Levels of Service

Level-of-Service A	Allows each person to choose a desired walking speed and to avoid conflicts with other pedestrians.
Level-of-Service B	Pedestrians begin to be aware of other pedestrians.
Level-of-Service C	Requires minor adjustments to speed and direction by pedestrians to avoid conflicts.
Level-of-Service D	Freedom to select individual walking speed and bypass other pedestrians is restricted. Frequent changes in speed and position are required.
Level-of-Service E	Provides for very crowded walking, at times reduced to shuffling, making reverse or cross-traffic flow very difficult. The speed of virtually all pedestrians is reduced.
Level-of-Service F	A person is likely to be standing stationary in a waiting area or is able to walk only by shuffling. There is frequent, unavoidable contact with other pedestrians.

of AASHTO's *A Policy on Geometric Design of Highways and Streets*.) It is important to note that this approach may not adequately consider future potential volumes of pedestrians since it is based on existing levels of pedestrian use.

To achieve the recommended best practice, new roadway projects should include sufficient budget for pedestrian facilities. As discussed above, pedestrian improvements, as needed, should be retrofitted along existing streets, roadways, and highways incrementally as public funding or private redevelopment opportunities allow.

Controlled-access freeways are typically the only traffic rights-of-way that are not suitable locations for pedestrian facilities.

Along some highways, roadways, and streets, there may be natural barriers that limit the available space for pedestrian facilities (such as steep topography, shorelines, natural resources or other conditions). Even in these locations, analysis should be performed to consider the best methods for providing a continuous pedestrian travel way to the maximum extent feasible (which may require narrowing the width of the pedestrian facility for a short distance, installing structural spans, or other solutions to create a continuous path of travel for pedestrians.)

All designated pedestrian access routes in public rights-of-way must meet the requirements of the Americans with Disabilities Act (ADA). Refer to Toolbox Section 3—Accessibility for guidance.

Very Low Volume/Low Speed Streets and Shared Streets

Very low volume streets and shared streets require special consideration regarding design for pedestrian use. In rare cases, typically in local neighborhood alleys and shared streets specifically designed for multi-modal use, pedestrian sidewalks and walkways may not be needed. Traffic volumes and speeds must be very low–low enough that pedestrians, including children, feel comfortable in the street. The AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities states that in these cases, roadways should have traffic volumes of less than 400 vehicles per day with minimal pedestrian use.

The pedestrian bridge on the east shore of Kauai provides people with a place to exercise and enjoy the outdoors safely. (www.kauaipath.org)

This shared street bustles with activity on a sunny afternoon in Asheville, NC. (www.pedbikeimages.org/DanBurden)

Both Sides or One Side

As a recommended best practice, continuous sidewalks or walkways should be provided along both sides of all streets, roadways, and highways used by pedestrians. However, a sidewalk on one side may be adequate for some local streets, especially when this improves a condition where there were no sidewalks previously.

Various factors can influence the decision to place sidewalks along both sides or one side, such as available space within the right-of-way, existing physical limitations at the roadside, and which side of the street the most pedestrian origins and destinations (such as schools and bus stops) are located. Evaluating land uses can help to inform these decisions.

When sidewalks are placed on both sides, pedestrians can more easily walk on either side of the roadway. Sidewalks on one side of the road constrict pedestrian movement, typically causing pedestrians to walk in the roadway or illegally cross to reach their destination. According to Hawaii state law, where sidewalks are not provided, any pedestrian walking along and upon a highway shall, when practicable, walk only on the left side of the roadway or its shoulder, facing traffic that may approach from the opposite direction. (Hawaii Revised Statutes 291C-76)

Recommended Dimensions for Sidewalks and Walkways in Various Settings

The widths of sidewalks and walkways can vary depending on adjacent land uses, local requirements, the type of street or roadway, presence of trees and utilities, and predicted pedestrian activity. Recommended minimum dimensions are shown in Exhibit 4.4 for various types of streets and roadways (based on Hawaii recognized street classifications). As a general best practice, sidewalks and walkways along streets and roadways should be a desirable minimum of 6 ft (1.8 m) wide (a width that allows two people to walk side by side or to pass each other, either standing or in wheelchairs, comfortably).

See Toolbox Section 3—Accessibility for minimum horizontal clearances required by ADA. To meet ADA, sidewalks and walkways must contain a clear passage area with a minimum width of 4 ft (1.5 m). When located in urban areas, downtowns, or medium to high density residential areas, sidewalks generally

WHEN DETERMINING SIDEWALK AND WALKWAY DIMENSIONS, DESIGNERS SHOULD CONSIDER:

- *Local standards and preferences*
- *Characteristics of pedestrians using the facility*
- *ADA standards*
- *Surrounding land uses*
- *Pedestrian volumes (existing and projected)*
- *Type of street/roadway*
- *Roadside environment*
- *Available space within the right-of-way*
- *Location of existing utilities, poles, and structures*
- *Traffic characteristics*
- *Additional space that may be needed for landscape, trees, and furnishings*

EXHIBIT 4.4 ***Recommended Dimensions for Sidewalks and Walkways***

ROAD TYPE	PRINCIPAL ARTERIAL	MINOR ARTERIAL	MAJOR COLLECTOR	MINOR COLLECTOR	LOCAL RESIDENTIAL	LOCAL COMMERCIAL WITH ACCESS
Right-of-Way (Typical)	100 ft (30.5 m)	84 ft (25.6 m)	60 ft (18.3 m)	60 ft (18.3 m)	50-60 ft (15.2-18.3 m)	60 ft (18.3 m)
No. of Travel Lanes / Width of Roadway (Typical)	4-6 Lanes	4 Lanes	2 Lanes	2 Lanes	28 ft (8.5 m)	44 ft (13.4 m)
SIDEWALK WIDTHS						
Desirable	8 - 10 ft (2.4 - 3.0 m)	8 ft (2.4 m)	6 - 8 ft (1.8 - 2.4 m)	6 to 7 ft (1.8 - 2.1 m)	5 ft (1.5 m)	6 ft (1.8 m)
Minimum	6 ft (1.8 m)	6 ft (1.8 m)	6 ft (1.8 m)	6 ft (1.8 m)	5 ft (1.5 m)	6 ft (1.8 m)
With Planting Strip/Buffer	6 ft (1.8 m)	6 ft (1.8 m)	6 ft (1.8 m)	5 ft (1.5 m)	5 ft (1.5 m)	5 ft (1.5 m)
With Street Trees, No Buffer	10 ft (3.0 m)	10 ft (3.0 m)	8 ft (2.4 m)	8 ft (2.4 m)	–	–
Urban Center/Business District	10-15 ft (3.0-4.6 m)	10-15 ft (3.0-4.6 m)	Varies	–	–	–
LOCATION						
Desirable					Both Sides	Both Sides
Minimum	Both Sides	Both Sides	Both Sides	Both Sides	One Side	One Side
PLANTING BUFFER WIDTH WHEN USED						
Desirable	5 ft (1.5 m)	5 ft (1.5 m)	5 ft (1.5 m)	5 ft (1.5 m)	5 ft (1.5 m)	5 ft (1.5 m)
Minimum	4 ft (1.2 m)	4 ft (1.2 m)	4 ft (1.2 m)	4 ft (1.2 m)	4 ft (1.2 m)	4 ft (1.2 m)

Note: Refer to the AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, as well as other AASHTO guides for additional information.

need to be wider to accommodate higher volumes of pedestrians. For example, a common standard width for urban arterial sidewalks is minimum 8 ft (2.4 m) wide, but this is not wide enough in areas that experience frequent pedestrian activity.

Sidewalks and walkways should be designed to comfortably accommodate the typical volume of pedestrians that will be using them. In high use areas like central business districts, sidewalks generally should be 10 to 15 ft (3.0 to 4.6 m) or wider to accommodate high pedestrian flows. However, It is important to avoid "over design" of excessively wide sidewalks. Wide spans of empty pavement can appear uninviting to pedestrians.

If the facility is a shared use path (shared with bicyclists), it must be an absolute minimum of 8 ft (2.4 m) wide and often wider depending on the use (see Toolbox Section 7—Shared Use Paths).

The dimensions listed in Exhibit 4.4 are guidelines. Dimensional requirements may vary within each local jurisdiction (check local requirements). Consider each project on a case-by-case basis to find the best possible design solution to fit the anticipated volume of pedestrian use.

Buffers/Separation

Providing a buffer can improve pedestrian safety and enhance the overall walking experience. Buffer width is the distance between the sidewalk and the adjacent roadway. Per the AASHTO Guide for the Development of Bicycle Facilities, desirable minimum buffer widths as measured from the edge of the traveled way are:

- Local or collector streets – 2 to 4 ft (.6 to 1.2 m)
- Arterial or major streets – 5 to 6 ft (1.2 to 1.8 m)

  Note: These measurements are typically for roadways and streets with curbs; check clear zone requirements on roads without curbs.

However, if the buffer area is landscaped and includes trees, 2 ft (0.6 m) is not wide enough. A minimum of 4 ft (1.2 m) is recommended. Some trees may require more space. Consult with a landscape architect and/or arborist to determine spatial needs for the trees proposed. See Exhibit 4.4 for recommended buffer widths related to street type. Buffer areas also provide space for light poles, utilities, signs, and street furniture, as well as protection from splashing and car door openings.

Double check the clear zone requirements as part of the design of buffers along all streets and roadways.

Highways as Main Streets, Rural Areas, and Shoulders

In many small towns and villages, state highways are the main street and primary arterial through the center of town. They function as the major route into which local arterials and collectors feed. In many towns in Hawaii, the state highway is often the only arterial connecting virtually all major destination points (such as schools, parks, scenic stops, and residential and commercial areas). Providing sidewalks and walkways along these sections of highway that have many potential pedestrian trip generators is important.

Providing adequate pedestrian facilities along the state highways in these settings is an important step to incorporating pedestrians into the state's overall transportation network. Sidewalks for these main streets need to be designed the same as they would be for the urban centers of larger cities, with sufficient width to support anticipated pedestrian use. It is important to remember that

Lahaina storefront

A pedestrian walks on the grassy shoulder on this Maui roadway.

WHEN ROADSIDE SHOULDERS ARE USED BY PEDESTRIANS

- *They can be paved or compacted crushed surface (firm and stable), but high visual contrast from adjacent roadway is best.*
- *Signs to prohibit parking should be installed unless sufficient width is provided to accommodate parking and pedestrians.*
- *Pedestrian use of roadside shoulders should be recognized as a need for more formal facilities/improvements, and treated as a temporary condition. The ultimate objective should be to construct sidewalks, walkways or shared use paths in these areas as soon as possible.*

there are differences between the small town main street environment and the larger city street environment, and applied design treatments should reflect community preferences.

Shoulder Use in Rural Areas

Shoulders along roadways in rural areas are sometimes used by pedestrians, even though shoulders are not formally recognized as pedestrian facilities. While this use is generally not the preferred condition, it does occur. As such, it is important for rural roadways and highways to meet at least minimum standards for shoulder width on both sides.

Even in completely undeveloped areas, where the roadways may not be intended as pedestrian routes, it is desirable to provide walking space along the traveled way for occasional or emergency use by pedestrians. This can be achieved by delineating the shoulder for added safety for non-motorized use.

Where a pedestrian route is needed to provide access between buildings or facilities, shoulders are not usually adequate or appropriate as pedestrian facilities, particularly when adjacent motor vehicle traffic may be traveling at higher speeds. Shoulders are not an appropriate option for pedestrian accessible routes (refer to Toolbox Section 3—Accessibility). In such cases, a full sidewalk or paved walkway, raised and/or separated from the roadway should be provided to the maximum extent feasible.

Shoulder Dimensions

Refer to local and state standards for applicable shoulder width requirements. As a general best practice, per the AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, shoulders should be:

- 4 to 6 ft wide (1.2 to 1.8 m) minimum adjacent to a bike lane and on local roads with lower traffic volumes
- 4 ft (1.2 m) minimum on roads with less than 400 ADT and 6 ft minimum on roads with 400 to 1500 ADT
- 6 ft (1.8 m) width is acceptable on roads with 1500-2000 ADT if minimum width of traveled way is 24 ft (7.3 m)
- 8 ft (2.4 m) wide minimum on roads over 2000 ADT

EXHIBIT 4.5 ***Minimum Roadside Shoulder Widths (AASHTO)***

ADT (Average Daily Traffic) Trips	< 400	400-1500	1500-2000	>2000
ROAD CLASSIFICATION				
Local Roads and Streets	4 ft (1.2 m)	5 ft (1.5 m)	6 ft (1.8 m)	8 ft (2.4 m)
Collector Roads and Streets	4 ft (1.2 m)	5 ft (1.5 m)	6 ft (1.8 m)	8 ft (2.4 m)
Rural and Urban Arterials	4 ft (1.2 m)	6 ft (1.8 m)	6 ft (1.8 m)	8 ft (2.4 m)

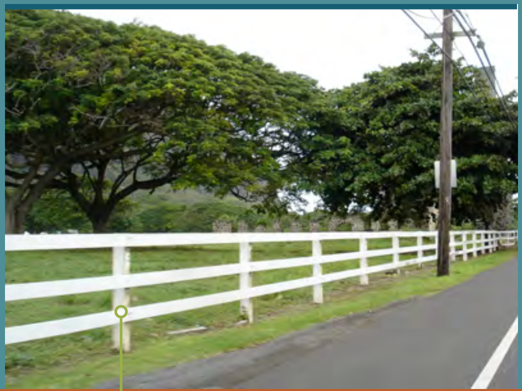
Shoulders along higher speed highways and roadways are generally not appropriate as roadside parking lanes (except during emergencies). Shoulders should be signed to prohibit parking. However, in the case that parking is expected along lower volume/ lower speed rural roads, shoulders should be a minimum of 12 ft (3.7 m) wide.

Shoulders may need to be wider in the vicinity of school bus stops or if located on major collectors/arterials (more than 2000 ADT). Refer to Toolbox Section 8—Children and School Zones for more information.

In rural areas experiencing heavy pedestrian use, the best solution is to construct a sidewalk, walkway, or path. If this can't be implemented immediately, the shoulder width should be expanded to be as wide as possible to serve the use–10 ft (3.0 m) minimum.

Shoulder Delineation

In areas where pedestrians and bicyclists may be using shoulders, extra-width striping should be provided to delineate the shoulder space. In some areas, it may also be possible to use a contrasting paving color (colored asphalt compacted fine cinders, chip seal, etc.) to help delineate these areas and visually separate the shoulder from street. This can provide an added benefit of traffic calming (perceived width of travel way is narrowed). Innovative approaches, such as dashed stripes or angled stripes could also be considered for delineation to draw motorist attention to the edge use by other modes.



Example of paved shoulder on Kamehameha Highway, Oahu

Runner along Maui highway walkway

Hamakua Heritage Corridor, Big Island (Rosa Say)

North Share Path on Oahu–
parallel to the state highway

In unpaved conditions or natural areas, well-compacted crushed rock or stone material can be provided adjacent to the roadway to provide extra space. Compacted earth or low-growing grass shoulders can also provide space for pedestrians if there are no other alternatives (but they perform poorly during wet weather). Unpaved shoulders are usually less costly to install, but more expensive to maintain. These are not formally recognized as pedestrian travel ways and generally should only be used in cases of emergency.

Clear Zone Requirements

AASHTO and HDOT have specific requirements limiting lateral obstructions along highways and roadways that can be potentially dangerous to motorists during crashes. The term “clear zone” is used to designate the unobstructed, relatively flat area provided beyond the edge of the traveled way for the recovery of errant vehicles. The clear zone includes any shoulders or auxiliary lanes. Clear zone widths are prescribed based on traffic volumes and vehicle speeds.

For rural collectors and local roads with speed limits of 45 mph or less, a minimum clear zone width of 10 ft (3 m) should be provided (AASHTO Green Book). No trees, poles, bollards, signs (unless designed with break-a-way posts and bases) or other fixed objects that create lateral obstructions can be located in this zone.

For urban arterials, collectors, and local streets where curbs are utilized and speeds are lower, less space for clear zones is required. A minimum offset distance of 18 in (500 mm) should be provided beyond the face of the curb (AASHTO Green Book). It should be noted that most curbs do not have a significant capability to redirect vehicles on highways and higher speed roadways. Where design/posted speed is greater than 45 mph, refer to AASHTO as well as state and local standards for additional clear zone guidance.

Additional offset from edge of roadway/face of curb may be needed depending on crash experience, number and location of driveways, type of adjacent development, on street parking, bike lanes, and available right-of-way widths. Necessary sight triangles for motorists and pedestrians should be examined and provided in design.

Separation on Higher Speed Roads

Along higher speed roadways and highways, sidewalks, walkways, and shared use paths should be removed from the traveled way, outside the clear zone, and separated by as much space as available within the right-of-way. In the case of extremely wide rights-of-way, the pedestrian route generally should be located within 20 to 30 ft or less from the roadway as suggested maximum separation. It is important that the pedestrian route is as convenient and direct as possible. Pedestrian facilities can also be situated within easements on private property. In these situations, the paths often function as two-way shared use facilities serving both pedestrians and bicyclists.

Where it is not possible to locate the paths outside the clear zone, traffic barriers may be needed to adequately protect the path users from high-speed vehicles, or speed reduction may need to be considered. (Fixed objects such as bollards or trees should not be installed in the clear zone along higher speed highways as measures to protect pedestrians.)

Ditches and Swales

On many rural roadways, an open ditch or swale is located along the edge to provide conveyance and treatment of stormwater runoff. Where there is sufficient space within the right-of-way, the sidewalk or walkway can be located beyond the ditch, providing a buffer area between motor vehicle traffic and pedestrians. Where a ditch or swale is constructed along a sidewalk, the adjacent slope should generally not exceed a 3 horizontal to 1 vertical grade, or at least 4 ft (1.2 m) of horizontal space should be provided adjacent to ditches with steeper slopes. Otherwise railing may be required (see discussion later in this section). A sidewalk separated from the roadway by a ditch is illustrated in Exhibit 4.16, later in this toolbox section.

Historic and Scenic Highways

Historic and scenic roads are unique resources with special management considerations.
In 2006 in Hawaii, legislation was passed to include flexible design guidelines consistent with practices used by the FHWA and AASHTO in highway design for special areas. This legislation allows flexibility in highway design to meet local

Old Mamaloa Highway, Big Island (Marjolein Visser)

Streetscapes are an essential part of the public space in cities and towns. (www.pedbikeimages.org/DanBurden)

conditions. The law addresses access for other modes of transportation along scenic and historic routes, including but not limited to, bicycle and pedestrian transportation.

Any improvements proposed to historic and scenic highways shall be designed to minimize environmental, scenic, aesthetic, historic, community, and preservation impacts. (Hawaii Revised Statutes 264)

Many historic and scenic roads are narrow in character, with little to no shoulder, and pedestrian/bicycle needs must be balanced with sensitive resources. When historic roads are part of a developed area or in a town center, pedestrian facilities are likely needed, but should be designed to retain the historic character of the corridor. Separation from the roadway edge can help to retain rural/historic character. Also, colored paving, special paving (unit pavers), or even compacted crushed stone can be considered for surfacing to help preserve and enhance the corridor character.

Applying design flexibility for scenic byways, historic routes, roadways adjacent to steep terrain, and other special conditions is important. Refer to AASHTO's *A Guide for Achieving Flexibility in Highway Design* for context-sensitive solutions that may be applicable in these areas. Also design of improvements on designated scenic byways needs to be consistent with HDOT scenic byway policy and plans. Corridor management plan have been developed for some scenic byways, and these plans should be referenced to confirm specific design guidelines and improvement needs.

Sidewalk Corridors and the Pedestrian Realm

The “sidewalk corridor” is a term often used in urban areas or town centers and generally encompasses the space between curb or street edge and the face of buildings or property lines along the street. The sidewalk corridor may include sidewalks or walkways, as well as space for landscaping, street trees, furnishings, utility appurtenances, signs, street lights, and other features.

Another term used to describe pedestrian areas in urban, suburban, or rural settings is the "pedestrian realm." The pedestrian realm encompasses the space between the edge of the street and the outside limit of the right-of-way (building line/property line), as well as any area pedestrians may travel within the right-of-way, including intersections and mid-block crossings.

The Streetside Pedestrian Realm in Urban Areas, Business Districts, and Downtowns

Urban streetscapes are important public resources, and collectively they are an essential part of the public space in urban areas. They represent a city's vitality and livability. Sidewalks in business districts, downtowns, and village/town centers need to be designed to efficiently accommodate heavy volumes of pedestrian traffic.

In urban areas, business districts, downtowns, and village/town centers, the streetside pedestrian realm serves multiple purposes and generally consists of the following zones.

- Building frontage zone
- Pedestrian through/travel zone
- Furnishings zone (aka fixtures/planting zone)
- Edge/curb zone
- Extension zone

The typical widths of each of these zones will vary depending on specific circumstances in the right-of-way. The function and typical dimensions for each zone are further described below. Refer to Exhibits 4.6 and 4.7, which show the zones of the streetside pedestrian realm.

Refer to Toolbox Section 5 for design guidance related to intersections and crossings, which are also important areas of the pedestrian realm.

Building Frontage Zone

The building frontage zone is where people enter and exit buildings and where pedestrians may travel at a slower pace to window-shop or to stop and chat. The frontage zone starts adjacent to the building or property line. In urban and developed areas, this zone can vary in width from approximately 2 to 10 ft (.61 m to 3.0 m) or more. Designers should allow a minimum of 2 ft (.61 m) "shy" distance, as people prefer

PEDESTRIAN REALM DESIGN CHECKLIST

- ✓ *Clearly visible through zone*
- ✓ *No obstacles or protruding elements in the through zone*
- ✓ *Moderate grades and cross slopes*
- ✓ *No vertical changes in grade levels*
- ✓ *Passing and resting areas in the through zone, as well as areas to gather and socialize in the furnishings zone*
- ✓ *Firm, stable, slip resistant surfaces*
- ✓ *Paving properly installed and maintained in a smooth condition*
- ✓ *Good lighting*
- ✓ *Good security and visibility—open sight lines, access to emergency services, an active environment*
- ✓ *Comfort—shade and heat mitigating design features*
- ✓ *Attractive environment for pedestrians—vibrant, interesting and well designed*

this width when walking adjacent to buildings. The frontage zone width should provide space for door openings, steps, architectural features, utilities, window shopping, signs, displays and similar provisions. Other recommendations:

- Keep this space as narrow and clear as possible.
- Construct the frontage zone at the same grade and level as the through zone.
- The surface material may be the same as the through zone, but accent paving or color can be used to delineate and distinguish the building frontage zone from the through zone.

Pedestrian Through/Travel Zone

The pedestrian through or travel zone is the predominant, obstacle-free space for pedestrian movement. This zone must remain both horizontally and vertically clear and provide a direct connection along pedestrian desire lines. In urban and developed areas, the through zone should typically be 6 to 10 ft (1.8 m to 3.0 m) wide, with a 4 ft (1.2 m) absolute minimum in accordance with ADA requirements. Other recommendations:

- Provide a firm, stable, and slip-resistant surface.

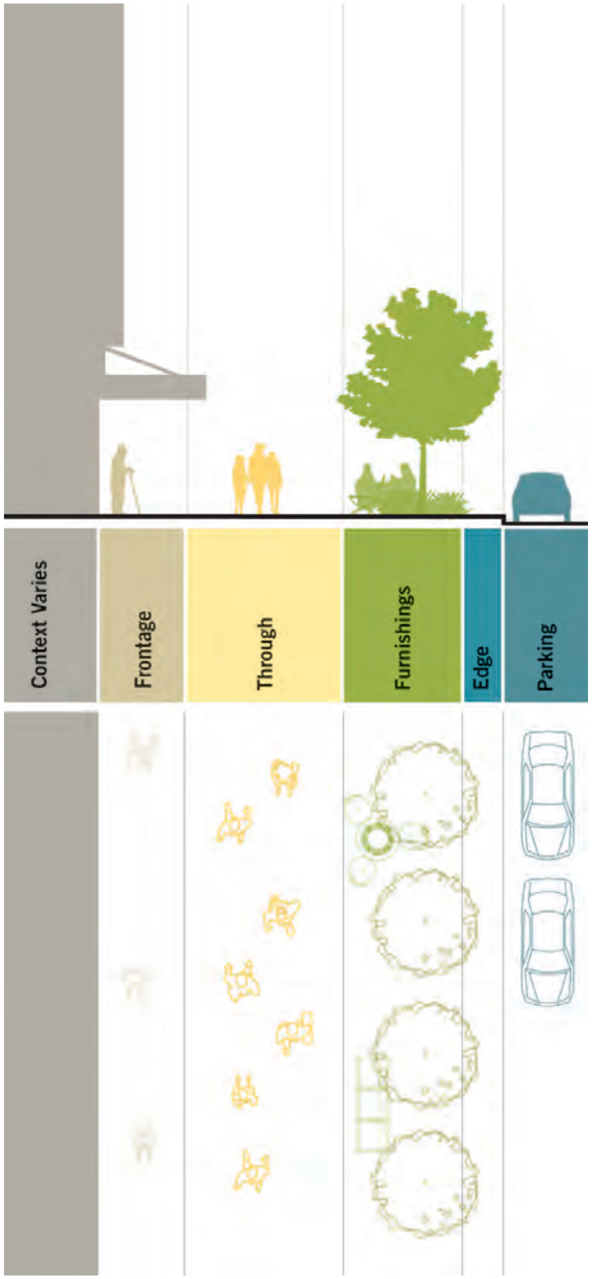
EXHIBIT 4.6 ***Streetscapes should be designed to be complete systems that blend all components into a safe, functional, attractive, and cohesive place. Kaimuki, Honolulu.***

- Increase the width of the through zone in places that will attract high volumes of pedestrians (near transit stops, malls, plazas, and other areas).

Refer to later in this section and Toolbox Section 3 for vertical clearance requirements.

Furnishings Zone

The furnishings zone may also be known as the fixtures or planting zone. This zone is often where street furniture, utility equipment, trees, landscaping, stormwater facilities, newspaper and entertainment flyer boxes, transit stops, and other features such as kiosks, sidewalk cafes,



vendors, and public art are located. This zone provides a buffer between street traffic and the pedestrian through/travel zone. Dimensions for this zone can vary widely.

If these areas are landscaped and contain street trees, a minimum width of 4 ft (1.2 m) is recommended. Certain trees may require more space. Involve a landscape architect and/or arborist in the design process to confirm special requirements. Other recommendations:

- Consolidate and organize furnishings to maximize public use and benefit.
- Provide paved areas across the furnishings zone where needed to allow pedestrian

EXHIBIT 4.7 ***Functions of the Pedestrian Realm Zones***

Frontage	Through	Furnishings	Edge	Parking
Area along the right-of-way that functions to provide space between the building façade, wall or fence and the through zone of the sidewalk	Obstacle-free space for clear pedestrian through travel that is often the primary walking area of the sidewalk	Primary buffer space between the active pedestrian walking area of the through zone and adjacent throughfares	Interface between the on-street parking or motor vehicle travel lane	
		Extension		
		Additional space for pedestrians and streetscape elements		

As well as improving pedestrian safety, curb extensions create added space for plantings.

access to crossings, taxi stands, bus stops, and other facilities.

- Provide screening/buffering of utility fixtures in this zone while maintaining clear access to utility providers for maintenance.
- Refer to Streetscape Furnishings (Exhibit 4.12) later in this toolbox section for examples of streetscape elements often provided in this zone.

Edge/Curb Zone

The edge or curb zone is adjacent to on-street parking, bike lanes, or motor vehicle lanes. It provides space to open a car door. It also may be where pedestrians wait for taxis and buses when combined with the furnishings zone (to become the extension zone). This zone is often where street lights, signals, traffic signs, parking meters, and street-related infrastructure are placed (these elements may also be placed in the furnishings zone. The width of this zone can vary. It is generally preferable to keep the edge/curb zone as narrow as possible. 12 in to 18 in (30.5 cm to 45.7 cm) is common. Other recommendations:

- Ensure that signs, street lights, parking meters, and other elements located in the edge/curb zone will not conflict with the use of the adjacent lane (whether for on-street parking, bike travel, or motor vehicle traffic). Provide adequate clear space/shy space around all appurtenances in the zone.
- Combine the furnishings zone and edge zone where necessary for transit stops and taxi stands. If not possible, provide a minimum of 5 ft (1.5 m) horizontal clearance where pedestrians are likely to wait for taxis or buses.

Extension Zone

The extension zone refers to locations where the streetside pedestrian realm may extend into the parking lane. Conditions include curb extensions (bulb outs), flexible use of parking lanes, bicycle parking, tree planting, landscaping, stormwater facilities, seating, and additional site furnishing areas. Extension zones are generally the same width as on-street parking lanes.

Interactions Between Zones

Because interaction occurs between these zones, development of a cohesive design for the pedestrian realm is important. Design must consider the unique conditions associated with each zone (such as adjacent land uses and context), as well as how the pedestrian realm interacts with other elements of the street (bike facilities, transit facilities, and intersections). Maintaining clear sight lines between pedestrians, bicyclists, and motorists in these areas of interaction is critical.

The Furnishings Zone as a Planting Buffer

The furnishings zone often functions as a planting buffer with street trees, landscaping, and/or natural vegetation. Planting buffers (also referred to as planting strips, landscape strips or buffers, verges, greens, and nature strips) are considered to be an effective separation treatment between walkways and streets in all types of settings. The added separation of a planting buffer helps a pedestrian feel more comfortable when walking along the street. Trees and landscaping also soften the urban environment, provide shade, reduce heat, and create a more pleasant walking environment. Planting buffers can be landscaped in a variety of ways to aesthetically enhance the streetside environment. (Refer to Street Trees and Landscaping in Toolbox Section 2.)

A bioswale was designed to convey and filter stormwater along this street in Seattle, WA. (www.epa.gov)

Stormwater infiltration system on a green street in Portland, OR. (www.pedbikeimages.org/LauraSandt)

EXHIBIT 4.8 Summary of Pedestrian Realm Guidelines

ZONE	FRONTAGE	THROUGH	FURNISHINGS	EDGE	EXTENSION
WIDTH					
	18 in wide as a general rule	**6 ft** desirable min width in urban areas/downtown, can be wider to accomodate pedestrian volumes	**3 ft** suggested absolute min in urban areas, may be wider for specific furnishings/public space	**6 in** (just the width of the curb, where there is no parking lane, or no continuous planting)	Width of parking lane - **7 ft to 8 ft**, typically in urban areas
	Up to **24 in** wide on commercial and mixed-use streets	Absolute min of **5 ft** in urban areas, not including edge or furnishings zone	**4 ft** min where trees or large shrubs are provided	**2 ft** min where there is a parking lane	
	Less width where a continuous building setback is provided	**4 ft** min clear travel space must be provided for ADA	**4 ft** (+ 1 ft for every 5 mph increment over 25 mph)	**2 ft 6 in** min where there is angled or perpendicular parking to allow space for car overhang	
		On narrower sidewalks or with a narrow furnishings zone, tree grates may extend into this space (not preferable)	Tree grates may be located in this area (typically 4 ft or 5 ft square or round)	**5 ft** min where pedestrians may wait for taxis or buses	
USE					
	Pedestrian shy distance along the building facade	Main path of travel for pedestrians, clear of obstacles; accessible walking surface	Streetscape furnishings, street trees and landscaping, newpaper boxes, utilities (fire hydrants, electrical boxes, etc.), and other elements	Walkable surface when adjacent to parking or part of transit	Provides for flexible use of parking lane for curb extensions at crossings, such as additional space for stormwater facilities and furnishings
	Window displays, cafe settings			Place for vertical elements such as street signs, street lights, utility poles, parking meters, etc. with 18 in clearance to curb	
	Furnishings aligned with frontage			Street trees and basins, with non-continuous planting	
	Overhanging elements				

Planting buffers can also be bermed and bordered by curbing, or developed at the same grade level as the roadway. Along state highways, where trees are planted, HDOT requires planting buffers to be two times the diameter of the root ball. In areas where there is limited space or right-of-way, the width of the planting buffer can be reduced or eliminated and provided again where there is more space or right-of-way available. Photos on pages 4-20 and 4-22 and Exhibits 4.6, 4.7, and 4.17 illustrate various types of planting buffers between sidewalks and streets.

The planting buffer also can house a number of natural drainage facilities. Sustainably-minded designers can:

- Install a street swale within planting strip rather than groundcover vegetation alone to better manage stormwater.
- Design planted areas within the curb extension so as to capture stormwater according to current standards.
- Install stormwater street planters that are designed to control flow and improve water quality.
- Install tree pits or tree box filters with drought and water-tolerant trees, under drains, and directed gutter flow.

Horizontal and Vertical Clearances

Urban streetscapes should be carefully designed in order to provide adequate space for furnishings and utility facilities outside the main travel way used by pedestrians. A clear path of 4 ft (1.2 m) absolute minimum is required within the width of all sidewalks and walkways by the ADA. Please note this is only the minimal clearance required, and is not a sufficient overall width for sidewalks or walkways in any location. This minimal clearance is required for wheelchair passage, but in areas where pedestrian use is moderate to high, this minimum clearance is not sufficient. This clearance should be increased to the maximum obtainable, or the full width of the sidewalk. Obstacles, such as signs, street furniture, and newspaper stands, should be placed off to the side of the travel way, in the furnishings/ planting zone, as discussed in this toolbox section.

The vertical clearance needed for sidewalks and walkways is 6 ft 8 in minimum (2.0 m), 7 ft (2.1 m) preferred. The ADA requires that “objects protruding from walls (e.g., signs, fixtures, telephones, canopies) with leading edges between 2.25 ft (68.5 cm) and 6.7 ft (2.0 cm) above the finished sidewalk shall protrude no more than 4 in (10.0 cm) into any portion of the public sidewalk." A detectable railing must be provided if protruding objects exist and can not meet the above requirements. (Refer to PROWAG.)

Traffic signs located directly adjacent to or within the sidewalk need to be mounted and tree branches need to be pruned high enough to meet the recommended vertical clearance between ground level and the bottom of the sign. Informational and directional signs for pedestrians can be lower, if located a minimum of 3 ft (1.0 m) from the sidewalk.

A typical pedestrian travel way, designed to be clear of obstructions, is illustrated in Exhibit 4.9.

Gradient, Cross Slope, Drainage, and Utility Covers

Sidewalks and walkways should be designed with maximum longitudinal grades of 5 percent. Since sidewalk grades are typically designed to match adjacent roadways, sometimes it may be necessary to exceed this gradient, such as in areas of rolling or mountainous terrain. Where the walkway of a pedestrian access route is contained within a street or highway border, its grade shall not exceed the general grade established for the adjacent street or highway. (PROWAG 301.4.2) However, exceeding the 5 percent gradient should be avoided to the maximum extent feasible. Refer to Toolbox Section 3—Accessibility for additional information.

Sidewalk cross slopes shall be designed to a maximum of 2 percent. This facilitates positive drainage toward the street or adjacent planting buffer. Avoid surfaces that are too flat (less than .5 percent), because this may cause poor drainage and pooling on the sidewalk surface. Highway shoulders should also be designed at a 2 percent cross slope if pedestrian use is anticipated.

Locate drainage grates, manhole covers, hatches, vaults, and other utility covers outside the route of pedestrian travel. If this is not possible, openings in ground surfaces shall not permit passage of a sphere more than .5 in (1.3 cm) in diameter and should be mounted flush with

EXHIBIT 4.9 *Clear Travel Way and Proper Positioning of Street Furniture*

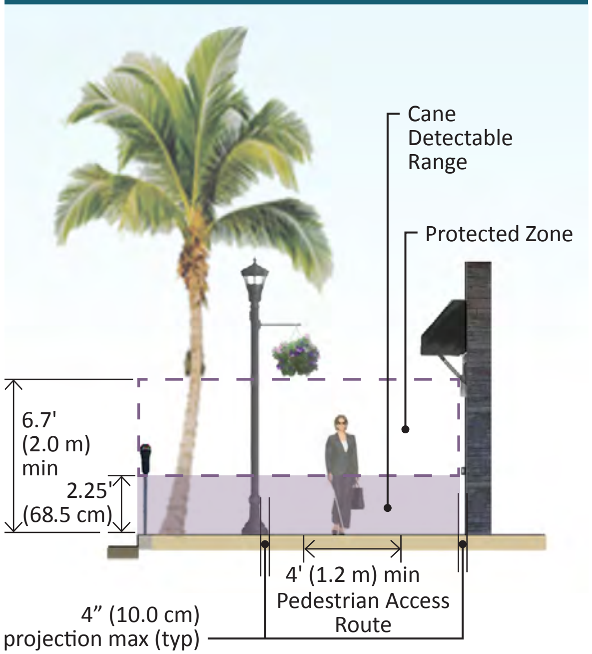
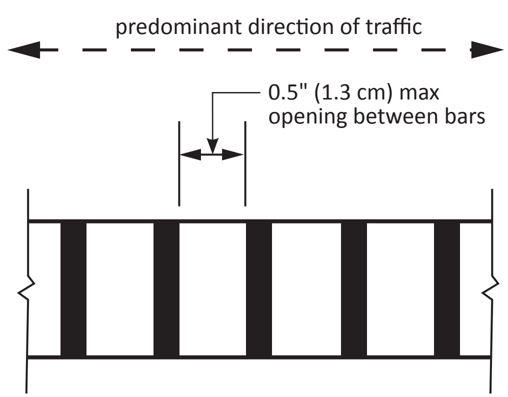


EXHIBIT 4.10 *ADA Grating Requirement*



the surrounding sidewalk surface. They should have a non-slip surface. Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel (See Exhibit 4.10). (Refer to PROWAG R301.7.1 and ADAAG 302.3.) For more information refer to the Toolbox Section 3—Accessibility.

Paving and Surfacing

Any material used for sidewalks and walkways must be slip-resistant and easy to maintain (resistant to buckling and cracking). Surfaces must be accessible by meeting the "stable, firm, and slip-resistant" criteria required by the ADA.

Types of Paving

Sidewalks and walkways in urban areas are typically constructed of portland cement concrete (PCC). This provides a smooth, long-lasting, and durable finish that is easy to grade and repair. Scoring patterns prevent cracking as the concrete sets, and may be designed to match historic patterns within a neighborhood or district where appropriate. Colored concrete is common, particularly in urban areas where sidewalks are often designed to blend with adjacent development.

A wide spectrum of unit paving options, such as concrete unit pavers, granite and other stone pavers, and brick are available. Special districts and downtown streets often incorporate special paving into the design of sidewalks and pedestrian areas. Special paving can enhance aesthetics and break up the monotony of a continuous concrete surface. Paving accents such as unit paver bands can provide a sense of scale and rhythm appropriate to surrounding buildings. Extensive use of unit paving with joints is not recommended on PARs. Refer to Toolbox Section 3—Accessibility for recommendations related to providing a vibration free zone within the PAR per PROWAG.) Exhibit 4.11 shows a number of surfacing options.

There are advantages and disadvantages to implementing unit pavers. They add visual interest and can complement the character of a setting. However, unit pavers may require repairs due to settling and crushing, resulting in the need for periodic re-setting. With sand joints, weed control is often a maintenance issue. When used, unit pavers must be set carefully, with a well-designed and constructed sub-base or else they may settle or buckle

EXHIBIT 4.11 ***Surfacing Options***

SCORED CONCRETE

COBBLESTONE

STAMPED COLORED CONCRETE

BRICK

CONCRETE - INTERLOCKING

GRANITE

Note: Refer to the MUTCD (2009) for guidance on paving and striping of pedestrian crossings. Colored pavement located between crosswalk lines should not use colors or patterns that degrade the contrast of white crosswalk lines.

Tree grates and unit pavers

A band of brick unit pavers recalls the historic character of this downtown district, while the concrete provides a smooth surface walkway.

and cause a tripping hazard. They should be designed to be easy to reset and replace. Unit pavers (that are not mortared in place) over utility lines are easier to take up and replace/ reset when repairs are needed.

Stamping molds can create the visual appearance of bricks and pavers and have the advantages of traditional concrete without the maintenance issues and roughness associated with bricks and pavers. Still, stamped surfaces can also have maintenance requirements. Compared to unit pavers, the sidewalk will never look the same after repairs are made because it is difficult to match patterns and colors.

Asphaltic concrete pavement (ACP) can be used as an alternative to PCC, but it generally has a shorter life expectancy. ACP is often used for paths in low density residential areas as well as the less developed urban areas. ACP will tend to settle and wear down faster than PCC sidewalks. It is also more susceptible to deterioration, root and vegetation damage, and requires more frequent maintenance. In areas where walkways are aligned adjacent to shallow-rooted shrubs and trees, root damage to the pavement can be prevented by installing root barriers. Refer to the HDOT standard plans for root barrier installation details.

Permeable Surfaces/ Recycled Materials

Pervious and permeable surfaces for pedestrian use are becoming more common in US cities due to the green building/sustainability movement. Pervious pavement brings environmental benefits because it allows the flow through of surface water. Pervious concrete, unit pavers with pervious joints, compacted crushed granite, rock and stone, and other treatments may be installed as permeable surfaces.

The use of recycled content in paving or for sub-base materials is also becoming a more common practice. With sidewalk replacement projects, it is sometimes possible to demolish old curb, gutter, sidewalk, and street paving and crush and grind the concrete and aggregate for reuse on-site during construction. Recycled pavement grindings can be inexpensive and easy to grade.

When considering the use of permeable paving and recycled content in paving, designers should examine construction costs and life cycle/maintenance costs, and jurisdictions need to adequately budget for these.

Rural and Natural Areas

In rural and natural areas, alternative surfacing, such as gravel or compacted earth (often with soil cement/binding agents) is occasionally used for walkways and trails. In many cases, these treatments may not be fully accessible to people using strollers or wheelchairs. Compacted crushed rock or stone is preferred in these uses because it can be constructed as a very smooth, firm, and stable surface. Typically, when facilities are regularly used by pedestrians, more permanent surfaces, including well-designed pervious or impervious paving treatments, are the most preferred solutions.

Any surfaces that are designated pedestrian access routes or accessible routes of travel must be firm, stable, and slip-resistant per accessibility standards.

Color/Reflection

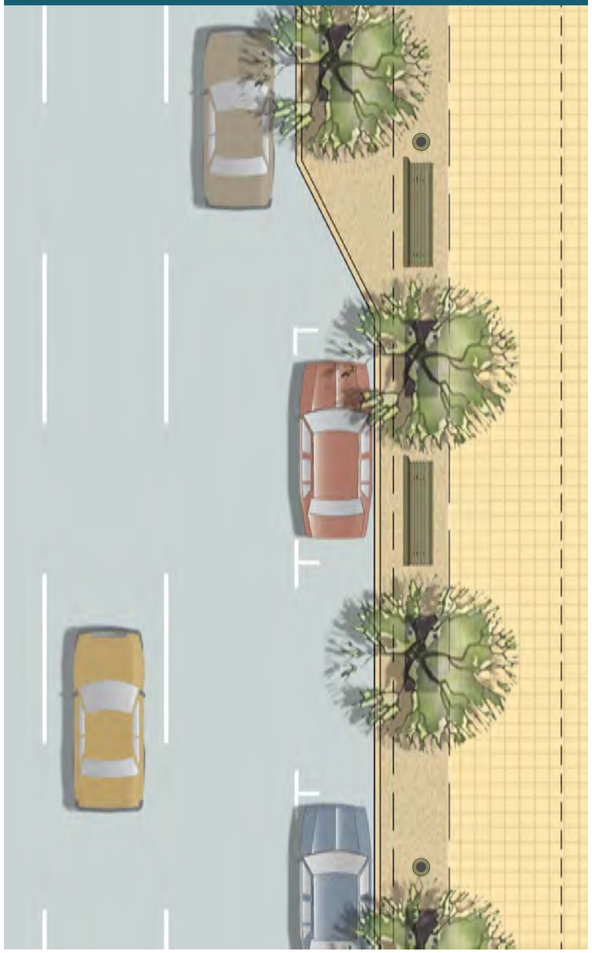
The color and reflectivity of paved surfaces is an important consideration in sunny climates. The Solar Reflectance Index (SRI) value of sidewalk materials may be increased to reduce urban heat island impact. This impact causes metropolitan areas to become significantly warmer than surrounding rural areas due to building and road materials. Material finishes may also be chosen that can reduce sidewalk glare and reflectivity.

Streetscape Furnishings

Design and select streetscape furnishings in accordance with the following considerations:

- A palette and placement plan should be developed for each streetscape project that includes furnishings, lighting, trees, landscaping, and paving. Placement of other features, such as signs, kiosks, parking meters, electric car charging stations, newspaper stands, etc. also needs to be carefully considered. Choose materials and styles for maximum durability, comfort, safety, security, and usability. The palette should illustrate how the streetscape will enhance the identity and character of the corridor and surrounding district in accordance with municipal requirements.

EXHIBIT 4.12 *Street Furnishings Located within the Furnishing and Extension Zones*



- Concentrate streetscape furnishings where pedestrians will benefit most from them. Furnishings will receive the most use and appreciation in predictable locations such as shaded areas of the street, transit stops, near intersection crossings and building entrances.
- Locate furnishings primarily in the furnishings zone, and secondarily in other areas, such as at curb bulbs at intersections, transit stops, and and where space permits.
- Integrate adjacent site furnishings with other streetscape elements to reduce clutter and creative a cohesive pedestrian environment.
- Furnishings can be located in the spaces at the block ends (curb extension areas) if the furnishings zone is narrow. When curb extensions/bulb outs are provided at mid-block—these spaces can support furnishings as well. Clustering furnishings at block ends and mid-block also will make it easier for passengers to access their parked vehicles.
- Providing good-quality street furniture will show that the community values its public spaces and is more cost-effective in the long run (i.e. more durable and vandal resistant; less maintenance required).

Exhibit 4.13 Streetscape Furnishings provides examples and placement guidelines for a variety of streetscape furnishings.

Meandering Sidewalks and Walkways

Sometimes, a meandering walkway is constructed, creating a planting strip with an informal, curving appearance. Although meandering walkways may look nice, they may not be the most efficient way of getting people from one place to another. They may also be misguiding to pedestrians with sight impairments who need better predictability.

If a meandering walkway is desired, minimize the number of curves to avoid creating a route that is too awkward and indirect. Meandering walkways can be used as a solution to avoid obstacles such as telephone poles, utility features, signs, etc. providing a smooth transition in the sidewalk alignment. Exhibit 4.14 illustrates a straight walkway and a walkway with a slight meander.

EXHIBIT 4.14 ***Straight vs. Meandering Walkways***

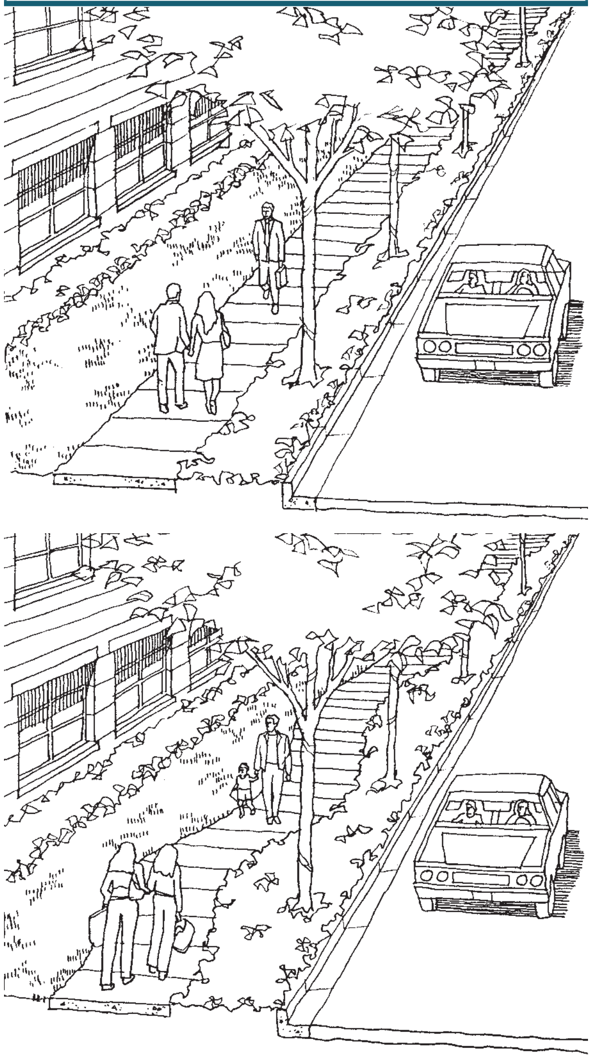
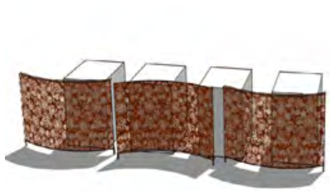


EXHIBIT 4.13 ***Streetscape Furnishings***

STREETSCAPE FURNISHINGS

TREE GRATES AND GUARDS

- When combined with tree pits/ boxes and good sub-structure, grates can provide enhanced growth environment
- Grates maximize space on sidewalk
- Guards only needed in areas where trees are susceptible



CUSTOM MANHOLES/ UTILITY SCREENS*

- Screens can hide unsightly elements
- Add character and interest to the pedestrian realm

KIOSKS/ PEDESTRIAN SIGNS

- Locate in key areas where pedestrians may change their route; pedestrian gathering areas, etc.
- Should be professionally designed by graphic artists
- Refer to Toolbox Section 2

TRANSIT STOPS/ SHELTERS

- Maximize shade
- Providing lighting for security
- Can be customized with special designs, artist and community involvement

DRINKING FOUNTAINS*

- Provide only in essential areas such as pedestrian gathering areas
- Provide good drainage to avoid wet surfaces
- Provide accessible height drinking fountains

**Note: These elements may be located in special improvement districts or private developments.*

EXHIBIT 4.13 ***Streetscape Furnishings, Continued***

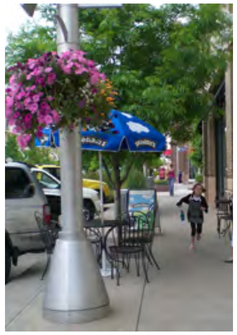
STREETSCAPE FURNISHINGS

BENCHES/ SEATING	BICYCLE RACKS*	BOLLARDS	TRASH/ RECYCLING RECEPTACLES	LEANING RAILS/ PROTECTION RAILING*
• Essential for pedestrian areas • Provide center/intermediate armrests on benches. • Wide variety of materials and styles • Low heat reflecting	• Essential for transit stops and at key bicycling destinations • See Bicycle Parking in Chapter 5	• Delineate pedestrian space. • Provide protection from vehicle movements. • Can be lit or unlit. • Keep height in scale with pedestrians.	• Street/pedestrian realm stay cleaner. • Coordinate recyclable containers with municipality programs. • Wide array of styles, colors, materials	• Provide protection from vertical drops of 30 in or more • Leaning rails are popular at transit stops

**Note: These elements may be located in special improvement districts or private developments.*

***EXHIBIT 4.13** Streetscape Furnishings, Continued*

STREETSCAPE FURNISHINGS

TABLES AND CHAIRS/ SIDEWALK CAFES*	HANGING BASKETS, BANNERS/ PEDESTRIAN LIGHTING	PLANTING BOXES/ POTS	PUBLIC ART	OTHER AMENITIES*
 	 	 	 	 
• Usually provided by adjacent property owners/businesses • Pedestrians prefer movable seating options • Shade is essential	• Add color, life, identity to the streetscape • Maintain horizontal and vertical clearances • Pedestrian-scale lighting enhances nighttime walkability	• Add color, life • Maintain horizontal and vertical clearances • Maintenance needs should be considered	• Adds character, enlivens the streetscape • Can be interactive; attracts pedestrians • Locate in special places • Can help with wayfinding • Involve local/regional artists	• Custom designed shade shelters, street clocks, and other elements add unique identity to the streetscape

**Note: These elements may be located in special improvement districts or private developments.*

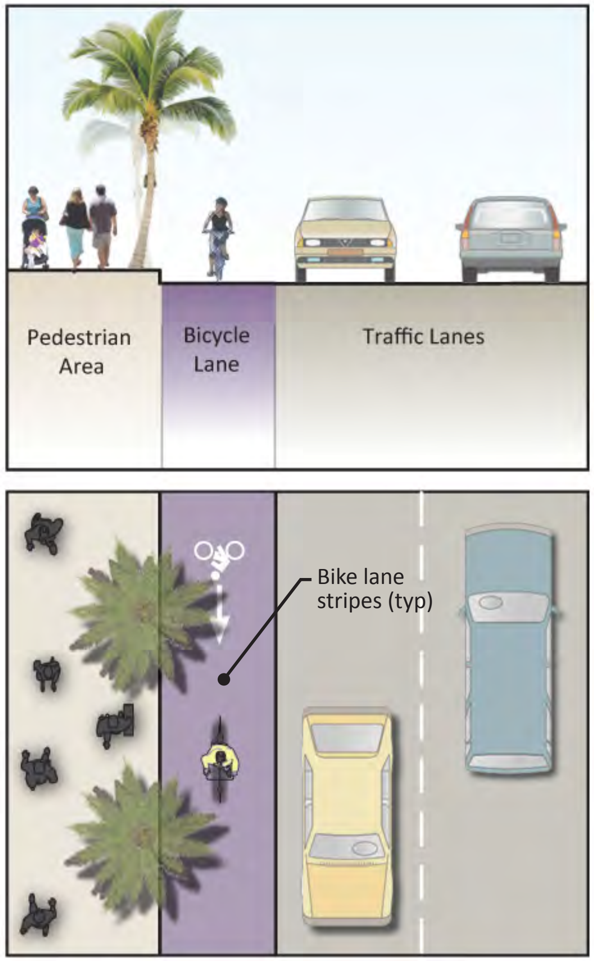
Bicycle Use Adjacent to and within the Streetside Pedestrian Realm

Bike lanes are beneficial for pedestrians because they provide an additional buffer between pedestrians and motor vehicles. Providing bicycle facilities and pedestrian facilities on streets, roadways, and highways helps to fulfill Hawaii's commitment to creating complete streets.

Bicycle facilities should be designed in accordance with the AASHTO Guide for the Development of Bicycle Facilities, Bike Plan Hawaii, and local jurisdiction standards and guidelines.

When bike lanes are located adjacent to the edge/curb zone, provide adequate clearance/shy distance from signs and other elements in the edge zone. Consider that bicyclists will ride as close the curb as possible and handle bars may come close to or overhang the curb edge. Bike lanes are typically located at the same level as the street grade, separated from the pedestrian realm by a curb. Exhibit 4.15 illustrates how a bike lane provides an additional buffer between pedestrians and motor vehicles.

EXHIBIT 4.15 *Bike Lanes as Separation*



Bicycles on Sidewalks

In the state of Hawaii, bicycles may be ridden on the sidewalk outside of business districts and Waikiki, at a speed of ten miles per hour or less provided that the bicyclists yield to any pedestrians (HRS 291C-148(b), ROH 15-4.6).

Bicyclists come in all ages and abilities. It is common for children to use sidewalks and walkways for riding smaller bicycles, tricycles, scooters, and other foot powered devices. Where this activity is anticipated, provide extra width in the pedestrian path of travel where feasible.

Higher speed, commuter bicyclists tend to prefer to travel in facilities in the street and normally would not use sidewalks, unless forced to. When adequate bicycling facilities are lacking, it is more common to see bicyclists using sidewalks and walkways, facilities that really have been designed for pedestrian-use only.

When higher-speed bicyclists use sidewalks and walkways that have not been designed for shared use, problems and conflicts with pedestrians can occur. A variety of safety concerns arise. The best solution is for bicyclists to have their own dedicated space within the street right-of-way unless a properly designed shared use path is provided within the right-of-way.

Some of the concerns related to bicyclists using sidewalks include the following:

- Motorists do not expect to see bicyclists on sidewalks and may pull out of intersections and driveways and collide with a bicycle.
- Sight distances are more limited along sidewalks for bicyclists and at driveway crossings for motorists. There may also be limited sight distance and clearances due to signs, utilities, landscaping, fencing, or other obstacles beside or protruding into the sidewalk.
- The potential for conflicts between bicyclists and pedestrians greatly increases in areas of shared use, such as sidewalks and non-delineated walkways. Pedestrian movements are often unpredictable for an approaching bicyclist from behind (especially those of small children), and pedestrians cannot always predict the direction an oncoming bicyclist will take.
- Bicyclists and pedestrians travel at different speeds. For example, pedestrians coming out of storefronts have little opportunity to see an oncoming bicyclist.
- When prohibiting bikes in areas of high pedestrian volume areas, such as business districts, proper warning signs are needed.
- According to Bike Plan Hawaii, sidewalks should only be used as bikeways under very limited circumstances.
- There is a need to provide bikeway continuity along high speed or heavily traveled roadways with inadequate space for bicyclists. In these situations, the best solution is a properly designed and adequately wide shared use path. However, as an interim solution, when there are no other bicycle facilities, the shared use of existing sidewalks and walkways can be considered. These segments should be signed so that pedestrians and bicyclists will be made aware of the shared use.

Small children often ride their bikes and push scooters on sidewalks.

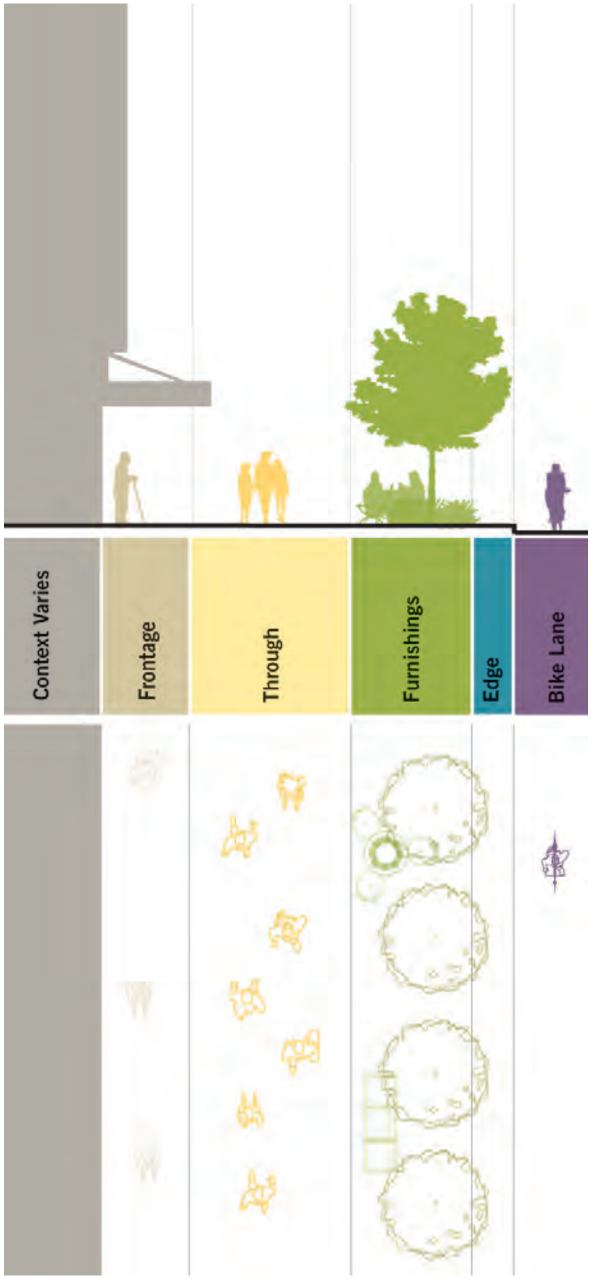


EXHIBIT 4.16 *Functions of the Pedestrian Realm Zones Including a Bike Lane*

Frontage	Through	Furnishings	Edge	Bike Lane
Area along the right-of-way that functions to provide space between the building façade, wall or fence and the through zone of the sidewalk	Obstacle-free space for clear pedestrian through travel that is often the primary walking area of the sidewalk	Primary buffer space between the active pedestrian walking area of the through zone and adjacent throughfares	Interface between the on-street parking or motor vehicle travel lane	
		Extension		
		Additional space for pedestrians and streetscape elements		

- On long, narrow bridges, where no bike lanes are available or shoulder widths are inadequate to accommodate bicyclists, they may be forced to share the sidewalk space with pedestrians. If bicyclists are to share sidewalks across bridges they should either be encouraged to dismount and walk as a pedestrian (unless the facility meets width requirements for shared use paths. See Toolbox Section 7). Providing ramps at the sidewalk approaches on both ends of the bridge allows bicyclists to more conveniently roll their bikes up onto the sidewalk after they have dismounted to walk across.

Curbing and Concrete Barriers

Curb and Gutter/Vertical Curb

Curb and gutter provides two primary functions: 1) control of stormwater drainage, and 2) vertical separation between motor vehicles and pedestrians. Curbs are often required on streets where efficiently controlled drainage is a necessity.

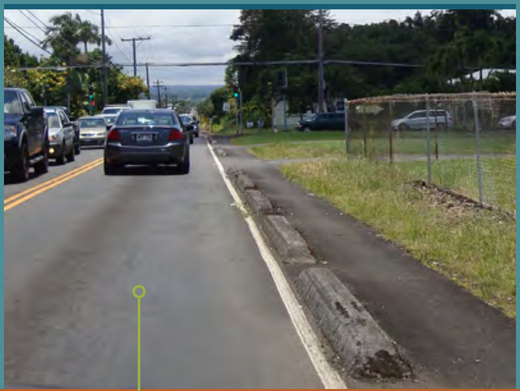
Curb and gutter/vertical curb provide a non-mountable barrier adjacent to street parking that prevents cars from parking on adjacent sidewalks. Curbs provide a physical barrier between moving vehicles and pedestrians, although curbs have limited ability to stop high speed vehicles.

Curbs can be costly to construct, so they may not be practical to build in all areas. Curbs also have an urban-looking appearance, which may not be desirable in some areas, where a more natural-looking rural roadside appearance is desired. A sidewalk adjacent to curb and gutter is illustrated in Exhibit 4.17.

Concrete Barriers

Concrete barriers (also called Jersey barriers) are occasionally used as a protective separation device between roadways and pedestrian travel ways, although their primary purpose is to shield and direct vehicles away from potential hazards. Another benefit of concrete barriers is that they can guide pedestrians to where they should cross the road. The AASHTO Roadside Design Guide provides more information on barrier placement and design.

Per the HDOT, concrete barrier height shall be a minimum of 32”. Short lengths of barriers are discouraged. Where a barrier is needed in two



Example of extruded curbing. See page 4-36 for cautions related to extruded curbs.

Example of a concrete barrier protecting a pedestrian way

or more closely spaced locations, continuous barriers shall be provided. End treatment design of concrete barriers shall include guard rail, flares, accentuators, etc. as required. (Refer to HDOT and AASHTO standards.)

Concrete barriers have some potential drawbacks. They tend to collect litter, fallen leaves and debris along the roadside and could become a barrier to drainage if placed improperly. Concrete barriers cost significantly more than curbing, and may not be the most visually appealing solution.

The ITE manual, Design and Safety of Pedestrian Facilities, provides some guidance about when it is necessary to provide pedestrian barriers. Vertical concrete surfaces adjacent to pedestrian facilities should be smooth to avoid snagging of clothing or abrasive injuries from contact with the surface. Bolts or other protrusions from walls, railings, or barriers need to be cut off flush to the surface or recessed.

Strongly Discouraged Edge Treatments

ROLLED CURB

Rolled curb is a mountable type of curb design traditionally used in suburban neighborhoods. Rolled curb has provided advantages to developers in that it eliminates the need for individual driveway cuts. However, rolled curb often presents a hazardous situation when used along sidewalks. Since rolled curbs are easily mountable by motor vehicles, drivers can easily drive onto sidewalks and often park up on top of the curb and block the sidewalk. Rolled curbs do not provide as strong a barrier as vertical curb between pedestrians and vehicles and should be avoided. A sidewalk with rolled curb is illustrated in Exhibit 4.17.

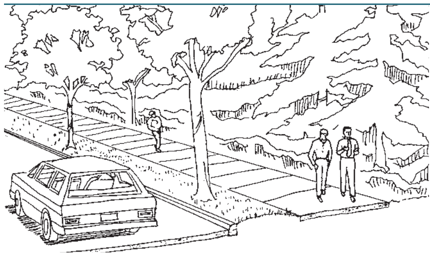
EXTRUDED CURBING

In suburban and rural areas, it is common to see extruded curb or other linear devices used to separate roadways from walkways. Although not a recommended practice today, these facilities historically have been placed along paved or unpaved walkways that are on the same grade as the adjacent roadway. Extruded curb have historically provided a relatively low cost vertical barrier between vehicles and pedestrians. However, there are several drawbacks to this type of edge treatment, and their ongoing use is generally not recommended. Strong consideration of the following problems is recommended before installing extruded curbing:

- Extruded curbs break down easily when hit by motor vehicles, increasing the need for frequent repair and replacement. Sometimes this type of curbing has difficulty staying attached to the pavement surface.
- These may become a barrier to drainage if designed and located improperly and tend to collect litter, fallen leaves, and debris along the roadside. (Breaks in the curbing at strategic locations will help, but maintenance is still more difficult than other types of curbing).
- Unless backfilled, extruded curbing can become an obstacle to pedestrian and bicycle travel as a raised element on the surface. The use of this type of curbing adjacent to bicycle lanes is strongly discouraged, unless placed outside the clearance area at the outside of edge of the bike lane. A minimum clearance of 2 ft (0.6 m) adjacent to a 5 ft (1.5 m) bike lane is recommended, creating a total lane width of 7 ft (2.1 m).

EXHIBIT 4.17 ***Street Separation and Edge Treatment Options***

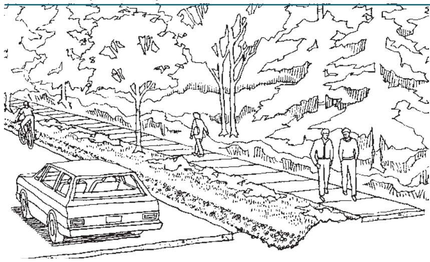
CURB WITH PLANTING STRIP



PROS
- Separation between pedestrians and street traffic
- Pedestrian comfort
- Ecological benefits
- Natural drainage opportunities

CONS
- Maintenance is required, and varies depending on type of landscape selected
- If not designed and maintained properly, landscaping may hinder visibility and cause security problems
- Root growth can sometimes damage adjacent paved surfaces if not protected

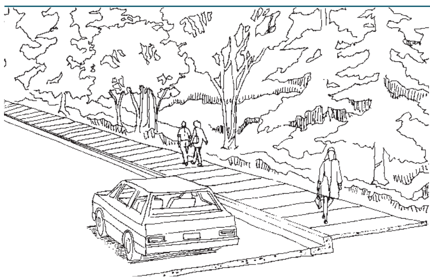
NO CURB, DITCH/SWALE AND PLANTING STRIP



PROS
- A larger separation between pedestrians and street traffic
- Natural drainage opportunities

CONS
- Maintenance is required, and varies depending on type of landscape selected
- Can collect trash and debris

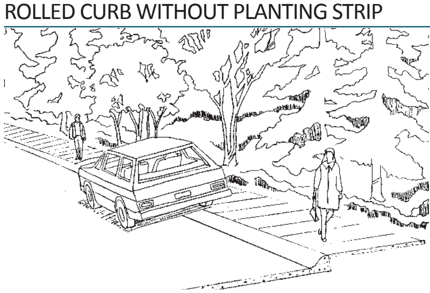
CURB WITHOUT PLANTING STRIP



PROS
- Controls stormwater drainage
- Separation between pedestrians and street traffic
- Prevents cars from parking on sidewalk

CONS
- Can be costly to construct
- Urban-looking appearance may not always be desired

ROLLED CURB WITHOUT PLANTING STRIP



PROS
- Eliminates need for individual driveway cuts (for developers)

CONS
- Hazardous to pedestrians because easily mountable by motor vehicles
- Drivers often park on curb and block sidewalk.
- A weak separation betewen pedestrians and motor vehicles

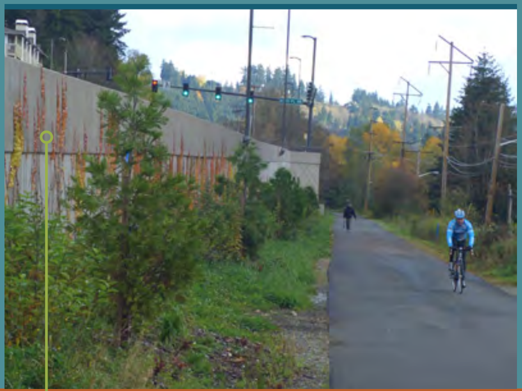
Side Slopes, Railings, and Walls

Careful design treatment of areas adjacent to sidewalks and walkways, such as side slopes, railings, and walls, is important for pedestrian safety and comfort.

Edge side-slopes steeper than 3 horizontal to 1 vertical should be treated as a drop off condition and a safety rail should be provided. A level area of 4 ft wide at a minimum is recommended along sidewalks and walkways where feasible.

The International Building Code requires a safety rail for vertical drops of 30 in (76.2 cm) or more. Other situations that should be examined for safety rails include slopes in excess of 2 horizontal to 1 vertical adjacent to a pedestrian path, located less than 4 ft (1.2 m) from the edge of the walkway.

Railing height along sidewalks, walkways and shared use paths is a minimum height of 3.5 ft (1.1 m). All handrails must comply with ADAAG and PROWAG. Safety rail or railing, sometimes referred to as pedestrian guardrail, is provided to protect pedestrians from vertical drop-offs or steep slopes. Safety railing used in conjunction



Special wall treatments help to mitigate the mass of blank walls along the Burke-Gilman Trail, SR 522, Kenmore, WA.

with pedestrian or bicycle travel is different than guardrail used in roadway design.

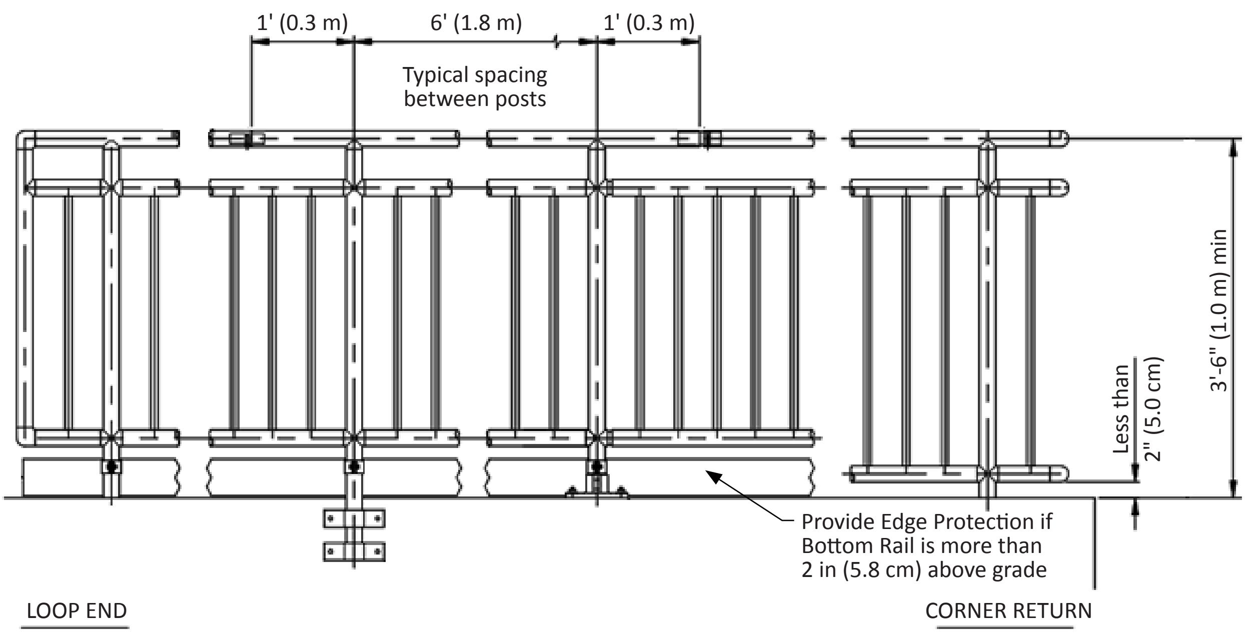
Determining the Need for Safety Railing

In areas where pedestrians are expected, regardless of frequency, the International Building Code requires safety railing for vertical drop-offs of 30 in (76.2 cm) or more. In situations where a drop-off is not adjacent to a pedestrian path, but is within a reasonable distance, the designer should determine whether a safety rail is needed on a case-by-case basis. Other situations that should be examined for including safety rail include:

- Slopes in excess of 2:1 adjacent to a pedestrian path (adjacent means located within 4 ft (1.2 m) or less from the path
- Sloped surfaces consisting of rough materials, such as revetment, adjacent to a pedestrian path
- The presence of traffic or a body of water at the bottom of a slope adjacent to a pedestrian path

EXHIBIT 4.18 *Wall Design Treatments*

EXHIBIT 4.19 *Typical Safety Rail/Type 1 Guardrail (Pedestrian)*



Safety Railing Design

All safety railing must be designed to comply with current ADA Accessibility Guidelines (ADAAG) and the International Building Code. Refer to Exhibit 4.19 for an example of typical safety railing design that meets these requirements. These requirements include the following:

- Top rail should be located minimum 3 ft-6 in (1.0 m) above grade adjacent to pedestrian areas and shared use paths and bicycling paths.
- Pickets and intermediate posts in the railing shall be designed such that a maximum size sphere of 4 in diameter cannot pass through any opening up to a height of 34 in (86.4 cm).
- Above 34 in (86.4 cm) to the height of the top rail, a maximum size sphere of 8-in diameter shall not pass through. (Note: the entire rail system can be designed so that a sphere of 4 in diameter cannot pass through openings, if desirable.)

Decorative railing example - "Big Flowers", designed by Jean Whitesavage and Nick Lyle.

Safety rail along a waterfront area

- The triangular openings formed by the riser, tread, and bottom rail at the open side of a stairway shall be of a size such that a sphere of 6 in diameter or greater cannot pass through the opening.

Railings and screens can be designed to be attractive, incorporating public art elements, aesthetically enhancing the pedestrian realm.

Because a mass of vertical walls can be imposing to pedestrians, designers should avoid high retaining walls immediately adjacent to sidewalks and walkways. The effect of retaining walls can be "softened" along pedestrian areas by terracing back on the slope with lower walls (when right-of-way is available) and providing landscaping. Avoid blank wall faces. Provide an attractive finish and texture, or screen with trellises and climbing plants.

Also refer to Exhibit 7.13 in Toolbox Section 7—Shared Use Paths.

Ongoing Sidewalk Maintenance

Well maintained sidewalks enhance pedestrian safety and mobility. Refer to Toolbox Section 11—Safety in Work Zones and Maintenance.

Other Resources

Refer to the following sources of information for additional guidance.

- American Association of State Highway and Transportation Officials (AASHTO). *A Policy on the Geometric Design of Highways and Streets, 5th Edition.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *A Guide for Achieving Flexibility in Highway Design.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for Development of Bicycle Facilities, 4th Edition.* 2012.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Planning, Design and Operation of Pedestrian Facilities*. 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Roadside Design Guide.* 2002.
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Midblock Crossings. 2008. **www.fhwa.dot.gov/publications/research/safety/08053/index.cfm** (May 2013).

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- National Complete Streets Coalition. **www.completestreets.org** (May 2013).
- New York City Department of Transportation. *Street Design Manual.* 2009.
- New Zealand Transport , Lester, T. *Public Lighting for Safe and Attractive Pedestrian Areas.* Agency Research Report 405. 2010.
- Oregon Department of Transportation and Oregon Department of Land Use and Conservation. Transportation Growth Management Program. *Main Street—When a Highway Runs Through It* (Main Street Handbook). 1999
- Public Rights-of-Way Access Advisory Committee (PROWAAC) to the US Access Board. *Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations.* **http://www.access-board.gov/prowac/alterations/guide.htm** (May 2013).
- Seattle Right-of-Way Improvements Manual, City of Seattle, Washington—online access: **http://www.seattle.gov/transportation/rowmanual/manual/4_21.asp** (May 2013).
- US Access Board. *ADA Accessibility Guidelines for Buildings and Facilities* (ADAAG). **http://www.access-board.gov/adaag/html/adaag.htm** (May 2013).
- US Access Board *Public Rights-of-Way Accessibility Guidelines* (PROWAG). Draft-rulemaking in process. **http://www.access-board.gov/prowac/** (May 2013).
- US Access Board. Sidewalk videos. **http://www.access-board.gov/news/sidewalk-videos.htm** (May 2013).
- US Architectural and Transportation Barriers Compliance Board: *Accessible Rights-of-Way: A Design Guide.* 1999.
- Washington State Department of Transportation. *State Highways as Main Streets: A Study of Community Design and Visioning.* 2009.


FREE

TOOLBOX SECTION

5

Intersections and Crossings

Hawaii's beautiful weather encourages pedestrian activity.

INTERSECTIONS AND CROSSINGS

Intersections and crossings occur wherever the pedestrian network intersects the roadway network. Pedestrians are extremely vulnerable at these locations because they move so slowly relative to vehicles, and they weigh so much less than vehicles. For these reasons pedestrian safety should be a high priority when designing or retrofitting intersections and crossings.

Pedestrians at a marked crosswalk

Since pedestrians are actually *in* the roadway/street at intersections and crossings, many of the recommendations below involve roadway design specifically, including markings, signs, signalization, and geometry. All designers, including roadway and traffic engineers, urban designers, landscape architects, and others should actively use the guidance in this toolbox section to enhance pedestrian safety.

Design Practices at Intersections

Intersection design requires consideration of all potential users, especially pedestrians who are the most vulnerable while crossing. Design solutions need to protect the safety of pedestrians, while also improving their accessibility and mobility. At the same time, design solutions still need to meet the needs of motorists and bicyclists. Carefully implemented engineering studies can help determine the best solutions for each location on a case-by-case basis. Sometimes what is the best design solution for pedestrians does not work well for bicycles and/or vehicles and vice versa. The needs of all intersection users must be considered.

IN THIS SECTION

EXHIBIT 5.1 Basic Principles of Intersection Design to Accommodate Pedestrians

Design compact intersections.
Eliminate unrestricted motor vehicle movements.
Reduce motor vehicle speeds through intersections.
Create crossings on all legs of an intersection.
Design crossing in a direct line, at 90 degrees to the direction of vehicular travel, as feasible.
Clearly identify crossings to all pedestrians, including those with sight impairments.
Avoid multiple and skewed intersections.

Commonly used crossing improvements include: crosswalks, curb ramps, pavement markings, pedestrian refuges, signalization, signage, and lighting. Exhibit 5.1 lists some basic principles of intersection design related to the needs of pedestrians.

DETERMINING THE NEED FOR CROSSING IMPROVEMENTS AT INTERSECTIONS

Intersections can be made more pedestrian-friendly by implementing designs that improve crossing conditions, reduce crossing distances, and minimize conflicts between pedestrians, bicycles, and motor vehicles. In all cases, the crossing treatment should be guided by engineering analysis that clearly determines the needs and provides recommendations for the improvement of pedestrian facilities. Each location should be studied on a case-by-case basis. Special conditions (such as land use, school routes, pedestrians with special needs, etc.) may exist that need to be addressed with pedestrian facilities.

Crosswalk Markings

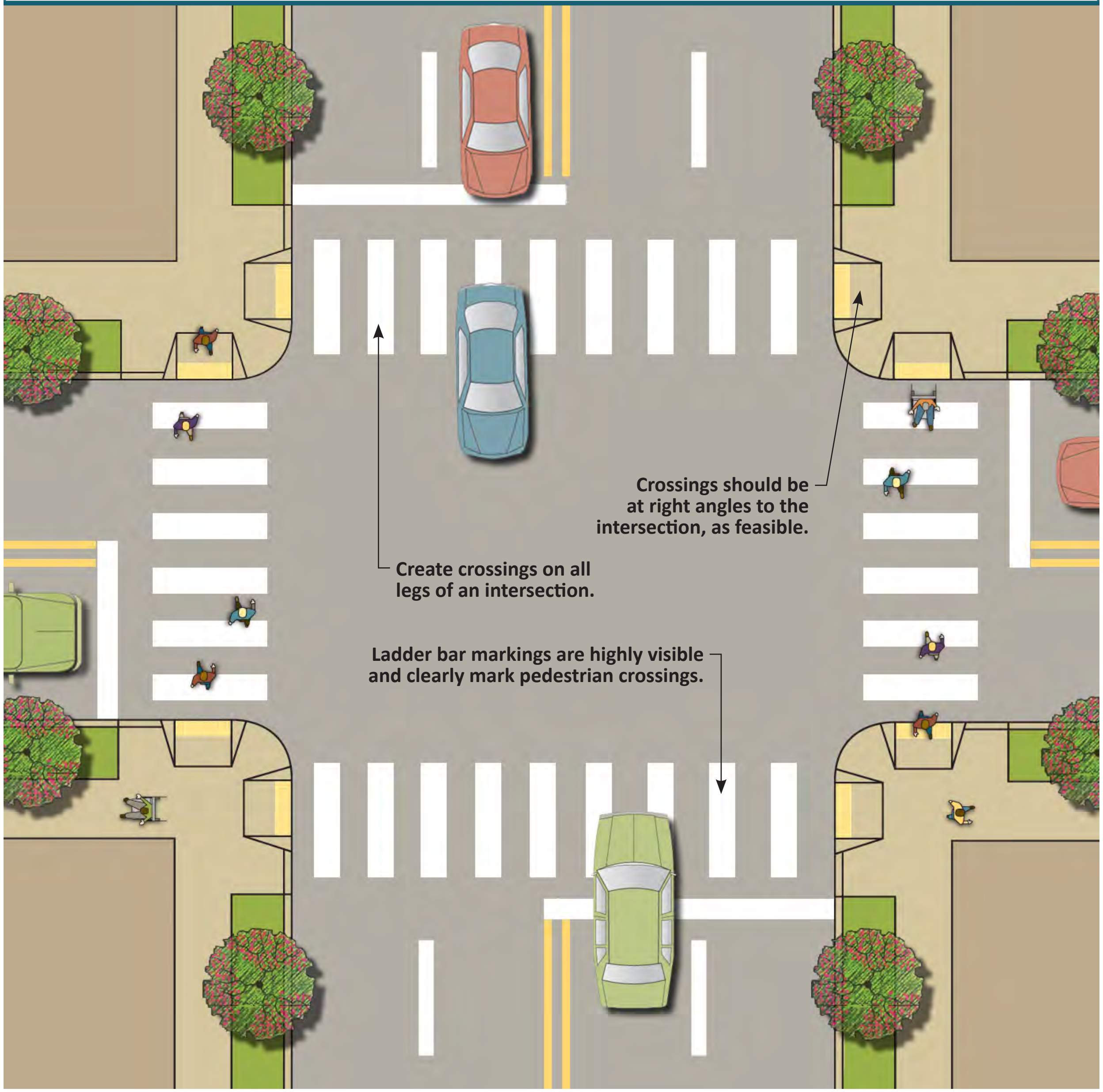
Marked crosswalks alert motorists to the potential of pedestrians crossing and define the area where pedestrians have the right-of-way. At stop-controlled or signalized intersections, the preferred marking, and the Hawaii Department of Transportation (HDOT) standard is the ladder style crosswalk.

On multi-lane roads with an ADT of 12,000 or more, marked crosswalks should always be combined with other pedestrian safety measures, such as stop or yield signs, signalization, or raised medians (see sidebar on page 5-3).

CROSSWALK DIMENSIONS

The HDOT standards require that crosswalks be a minimum of 10 ft (3.0 m) wide and at least as wide as the approaching sidewalk. In high pedestrian areas, crosswalks can be up to 20 ft (6.1 m). The approaching sidewalk and corner area at the intersection needs to be free of obstructions so that pedestrians can freely travel in either direction to cross the street. Exhibit 5.2 shows typical crosswalk markings at an intersection.Exhibit 5.3 shows typical crosswalk dimensions. The HDOT standards call for the width of the ladder bars to be 12 in (30.5 cm) with 18 in (45.7 cm) spacing.

EXHIBIT 5.2 *Typical Crosswalk Markings*



MARKING CROSSWALKS

The Federal Highway Administration's 2005 study, "Safety Effects of Marked versus Unmarked Crosswalks at Uncontrolled Locations", evaluated pedestrian crashes at 1,000 marked crosswalks and 1,000 matched but unmarked comparison sites. None of the sites in the study had traffic signals or stop signs on the approach to the crosswalk. The results of the study indicated:

ON TWO-LANE ROADS

- *There was no difference in crash rates based on the presence or absence of a marked crosswalk.*

ON MULTI-LANE ROADS

- *On roads with an ADT of 12,000 or more, the presence of a marked crosswalk alone, without any other improvements to pedestrian safety, was associated with a higher rate of crashes. (Meaning: additional improvements such as advance and overhead signs, refuge islands, etc. are needed at these locations.)*
- *Raised medians and refuge islands are associated with a significantly lower rate of pedestrian crashes with both marked and unmarked crosswalks.*
- *Painted medians do not significantly improve pedestrian safety at crossings, compared to multilane roads with no median at all.*
- *Older pedestrians have higher crash rates relative to their exposure than other age groups.*

ADVANCE STOP BARS

The advance stop bar increases the time for a vehicle to enter the intersection on green, and may result in a modest reduction in intersection capacity. However, advance stop bars may be of benefit in reducing the frequency of crashes from red-light running.

Crosswalks that lead to public amenities such as a park, beach, or civic building can be considerably wider than ten feet and can be enhanced with special markings or paving treatments (see below for types of markings).

TYPES OF CROSSWALK MARKINGS

Markings at crosswalks include striping patterns, stop bars, advance stop bars and yield signs, and sometimes other features. The ladder bar crosswalk marking pattern is the most frequently used because it is highly visible to pedestrians and motorists and can be spaced to avoid tire friction, thus reducing maintenance costs.

STOP BARS, ADVANCE STOP BARS

Stop bars are typically placed at intersections (where motorists are required to stop) to prevent overhang into crosswalk areas. Stop bars are normally 12 to 24 in wide (30.5 to 61.0 cm) white stripes that extend across all approach lanes. They should be located at least 4 ft (1.2 m) in advance of the crosswalk, and parallel to it. The HDOT standard is a 12 in (30.5 cm) wide white line, a minimum of 4 ft (1.2 m) in advance of the crosswalk. Where there are heavy truck volumes, the stop bar should be set farther back in the receiving street so that large vehicles have ample room to complete their turn. Stop bars

EXHIBIT 5.3 Crosswalk Dimensions

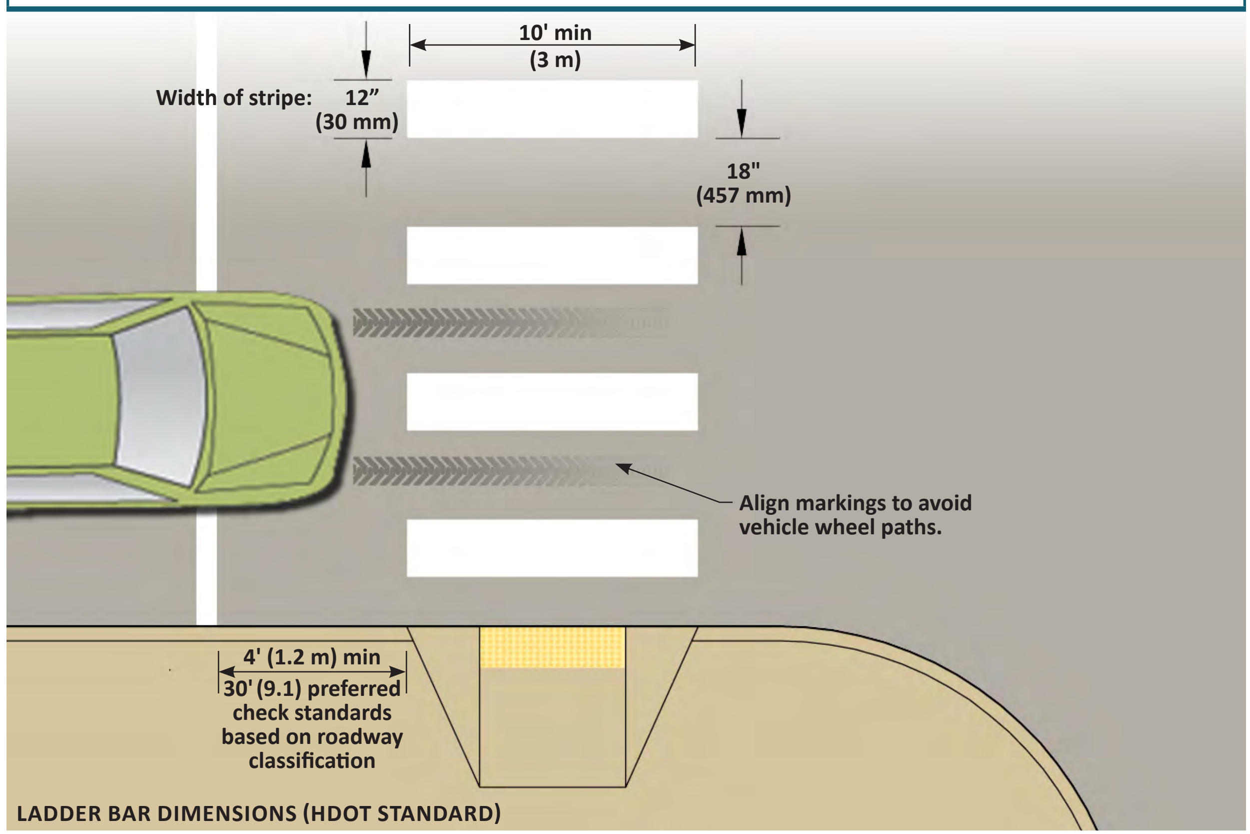
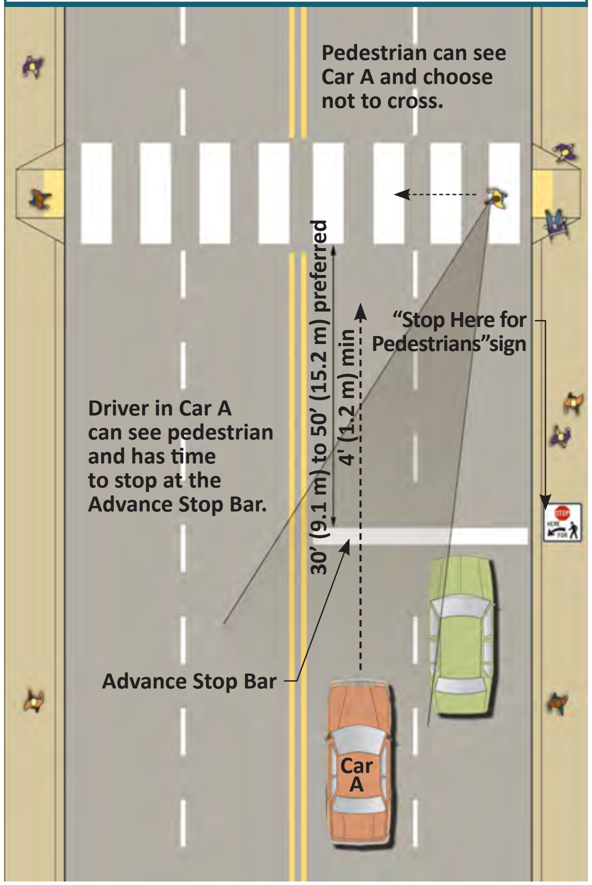


EXHIBIT 5.4 *An advance stop bar gives both pedestrians and motorists better visibility.*



can be installed at an angle for this purpose. Stop bars should also be used for right-turn-on-red movements and for vehicles turning left from the cross street.

On multiple lane roadways at uncontrolled approaches, advance stop lines increase the safety of pedestrians by reducing the screening effect of vehicles in the right lane. Advance stop bars should be used with a "Stop Here for Pedestrians" sign. (See Exhibit 5.4.)

RUMBLE STRIPS

Rumble strips with raised or recessed pavement treatments are sometimes placed in advance of crosswalks in rows, which create a "rumbling" effect alerting approaching drivers of the upcoming crosswalk. These types of markers should only be used if they can be placed far enough in advance of the crosswalk to be an effective warning device (at the same location as the crosswalk advance warning sign). Raised pavement markers must be placed outside the required clearance area of bike lanes and should only be installed after an engineering study determines they are appropriate. In addition, care should be taken in the use of rumble strips as they

Pedestrians use crosswalks in a variety of ways. (Source: A parrot talks in Chocolate.com)

Wide crossings with no markings create uncomfortable places for pedestrians.

Crosswalk markings clarify the space used by pedestrians.

Painted markings can deteriorate quickly. Regular inspection and maintenance contribute to pedestrian safety.

can cause higher noise levels which could affect nearby residents. They may be more suitable for gateways where frontage property is limited.

CROSSWALK MARKING MATERIALS AND MAINTENANCE

Crosswalk marking materials include inlay tape, thermoplastic, and paint. Exhibit 5.5 summarizes the qualities of each. Specific design details related to pavement striping and marking techniques can be found in the 2009 Manual on Uniform Traffic Control Devices (MUTCD). Other materials such as concrete, unit pavers, painted stencil patterns, and stamped asphalt may be used, but refer to the MUTCD for requirements related to contrast.

Markings should be monitored regularly, maintained in good condition, and should be removed when no longer needed.

EXHIBIT 5.5 ***Crosswalk Marking Materials***

INLAY TAPE	Highly visible, not slippery, requires expertise to install correctly; recommended for new and resurfaced pavement; more cost-effective than paint in the long run
THERMOPLASTIC	Highly visible, not slippery, may be a better option than tape on rough surfaces
PAINT	Low initial cost, but slippery and not as visible as tape or thermoplastic; requires frequent repainting

Source: Pedestrian and Bicycle Information Center (PBIC), Crossing Enhancements

Curb Ramps

Curb ramps are often considered to be the most important elements of an accessible pedestrian environment because they provide accessibility at the grade transition from the sidewalk to the street. They facilitate crossing for wheelchair users, people pushing strollers, bicyclists, and others. When properly located, they can also help direct pedestrians, including people who are blind or have low vision, toward the crosswalk. Toolbox Section 3—Accessibility discusses placement and design of curb ramps.

Signalization

DETERMINING THE NEED FOR PEDESTRIAN SIGNALS

Pedestrian signals should be installed wherever there is a traffic signal, except where pedestrians are prohibited such as on certain highways, as recommended by the Pedestrian and Bicycle Information Center (PBIC). Major factors in pedestrian signalization design include signal timing, types of signals, and placement and design of both signals and pedestrian actuators. Signalization should be designed in accordance with an engineering study. The MUTCD provides guidelines for determining warrants for signalization based on:

1. Vehicular traffic alone
2. A combination of pedestrian and vehicular traffic
3. School zone pedestrian and vehicular traffic
4. Crash experience

See the 2009 MUTCD Section 4C for more information.

The revised minimum pedestrian volume warrant in the MUTCD states that a traffic signal may be warranted when the pedestrian volume crossing the major street at an intersection or mid-block location during an average day is either (1) 100 or more for each of any four hours or (2) 190 or more during any one hour. These volume requirements may be reduced by as much as 50 percent when the predominant crossing speed is below 4 feet per second/fps (1.2 meters per second/mps). A traffic signal may not be needed, however, if adjacent traffic signals consistently provide gaps of adequate length for pedestrians to cross the street at least every minute.

It should be noted that these are guidelines. Engineering analysis should be conducted on a case-by-case basis to determine the need for traffic and pedestrian signals. The analysis may consider special factors, including proximity of the intersection to school zones, as well as areas where pedestrians with special needs may use the intersection (such as near senior centers, hospitals, etc.). The best practice is to consider the needs of pedestrians, along with all other intersection users, in the analysis process.

PEDESTRIAN SIGNAL INDICATIONS

See the American Association of State Highway and Transportation Officials (AASHTO) *Guide for the Planning, Design, and Operation of Pedestrian*

Pedestrian signal showing flashing upraised hand with countdown display, Kirkland, WA

Pedestrians cross streets at various rates of speed.

Mid-block crossings can improve mobility and increase pedestrian activity.

Facilities for locations where pedestrian signal indications should be provided at traffic signals. Provide pedestrian signal indications where:

1. Traffic signals are installed based on meeting the minimum pedestrian volume or school crossing warrants (see MUTCD warrants).
2. Pedestrian pushbuttons are in use.
3. A protected signal phase is provided for pedestrian movements in one or more directions at a signalized intersection, with all conflicting vehicular traffic being stopped.
4. No vehicular indications are visible to pedestrians either starting or continuing their crossing (such as at intersections with pedestrian refuge or crossing islands).
5. The vehicular indications that are visible to pedestrians provide insufficient guidance for them to decide when it is safe to cross, such as at one-way roadways, T-intersections, or multiphase signal operations.
6. An established school crossing is located at a signalized intersection.
7. Engineering judgment determines that pedestrian signal heads would minimize vehicle-pedestrian conflicts.
8. Most of the other signalized intersections are already equipped with pedestrian signals.
9. Significant numbers of older adults or school-age children are present.
10. Wide streets where providing pedestrian clearance is important and moderate to high numbers of crossings occur.
11. Pedestrians request signal heads on the basis of program accessibility at locations where an engineering study confirms that installations of pedestrian signal heads is appropriate.

The above guidance applies to existing intersections with traffic signals. When new intersections are constructed or when existing intersections are reconstructed, intersections must be designed to meet accessibility requirements, including the provision of accessible pedestrian signals. Refer to Toolbox Section 3—Accessibility for more information. Also refer to the *Guide for the Planning, Design, and Operation of Pedestrian Facilities* for more information including innovative pedestrian indication options.

SIGNAL TIMING/PEDESTRIAN CROSSING TIMES

Pedestrian signal timing is based on pedestrian crossing times. A speed of 3.5 fps (1.06 mps) is the new standard used by the 2009 MUTCD. However, studies have indicated that up to 30 percent of the population does not normally walk this quickly, and the Institute of Transportation Engineers (ITE) manual *Design and Safety of Pedestrian Facilities* recommends the use of three fps (.91 mps) for signal timing. When there is a known presence of slower pedestrians (including older adults or people with mobility impairments), a crossing speed of 2.5 fps (.76 mps) is recommended.

Increasing the timing of pedestrian crossing phases can impact intersection capacity for traffic movement (motorists have to wait for longer periods). It is important to balance the needs of all intersection users when establishing signal timing parameters. The context, volume of pedestrians crossing, the presence of pedestrians with special needs, and other factors need to be considered in the decision-making process.

The amount of time given to vehicular travel also influences pedestrian safety. Signals with excessively long waits may cause pedestrians to cross against the signal, increasing the potential for pedestrian/motor vehicle conflicts. Research indicates that many pedestrians stop watching for the light to change when their delay exceeds 30 seconds, and instead they start looking for gaps in traffic to cross streets. Installation of pedestrian actuation devices can help with this problem.

While it is not practical to provide a pedestrian crossing phase every 30 seconds at all intersections, it is important to understand pedestrians' potential reactions to delays and to adjust crossing timing to serve their needs as a best practice. For example, pedestrians can push actuators when provided to activate the pedestrian crossing phase sooner. When pedestrians are not present, phasing can provide more time for vehicle movements. Exhibit 5.6 shows pedestrian crossing times for various distances and pedestrian mobility.

APPROACHES TO SIGNAL TIMING

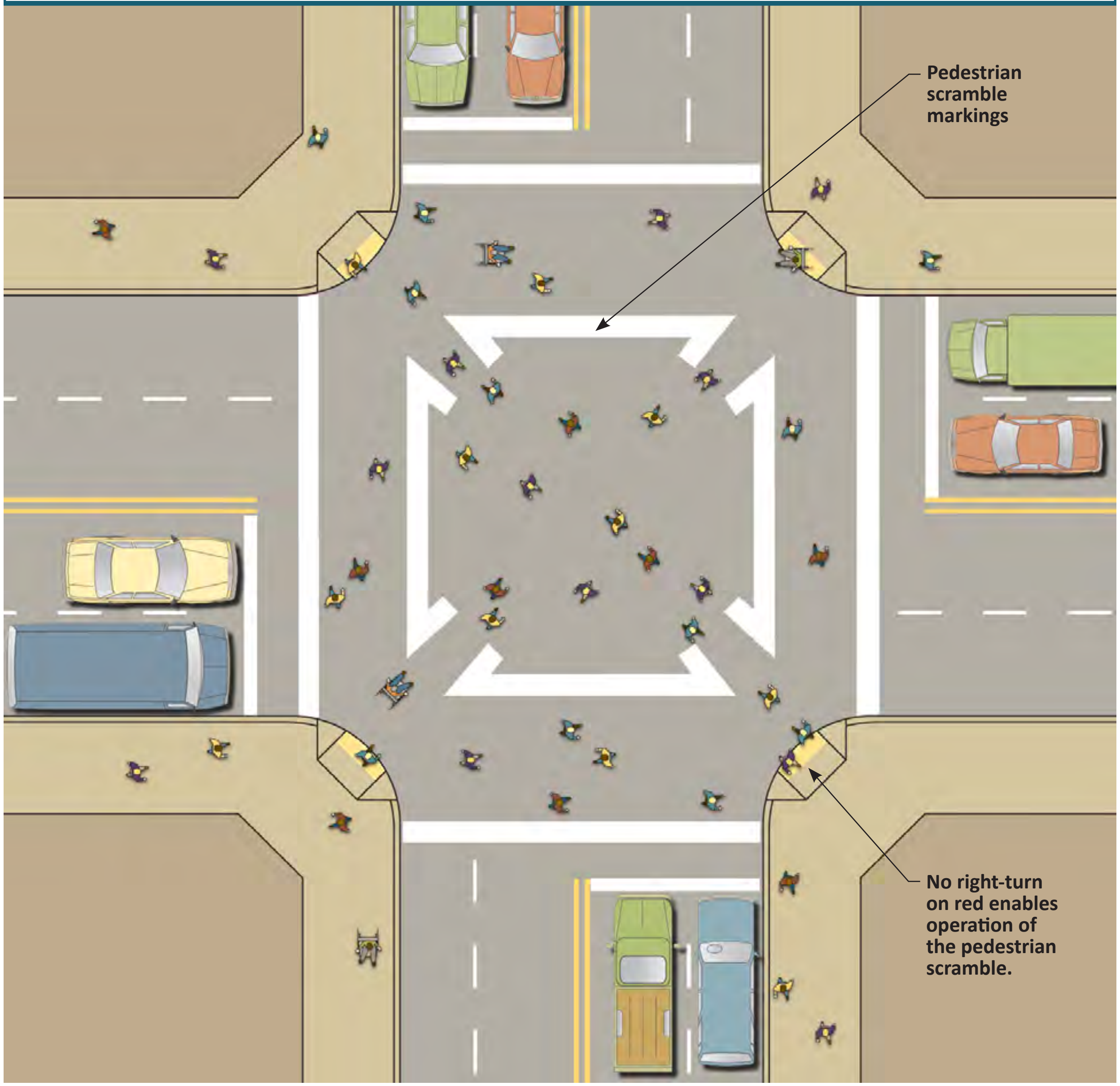
There are three main approaches to signal timing: concurrent, exclusive, and leading pedestrian interval. Shorter cycle lengths and longer walking intervals provide better service to pedestrians, and fixed time signals work best (PBIC). Timing for each intersection needs to be analyzed and set on a case-by-case basis with consideration of all intersection users.

EXHIBIT 5.6 ***Pedestrian Crossing Times, Speeds, and Distances***

CROSSING DISTANCE	AVERAGE PEDESTRIAN CROSSING TIME*	OLDER ADULT CROSSING TIME	MOBILITY IMPAIRED PEDESTRIAN CROSSING TIME
	at 3.5 ft/second (1.06 m/second)	at 3 ft/second (.91 m/second)	at 2.5 ft/second (.76 m/second)
24 FT – 2 LANES (7.3 M)	6.9 seconds	8 seconds	9.6 seconds
34 FT – 2 LANES WITH BIKE LANES (10.4 M)	9.7 seconds	11.3 seconds	13.6 seconds
46 FT – 3 LANES WITH BIKE LANES (14 M)	13.1 seconds	15.3 seconds	18.4 seconds
58 FT – 4 LANES WITH BIKE LANES (17.6 M)	16.6 seconds	19.3 seconds	23.2 seconds
70 FT – 5 LANES WITH BIKE LANES (21.3 M)	20 seconds	23.3 seconds	28 seconds

**Recommended by 2009 MUTCD*

EXHIBIT 5.7 *Exclusive Signal Timing: At a pedestrian scramble all traffic is stopped and pedestrians can cross in any direction.*



- ***Concurrent Timing:*** The green traffic signal and the walk signal go on simultaneously. Turning motorists are expected to yield to pedestrians in the crosswalk. This type of timing usually provides pedestrians with the shortest waiting times and most opportunities to cross.
- ***Exclusive Timing:*** Stops traffic in all directions and should be used in conjunction with "no right on red." It is useful where there are very high pedestrian volumes (more than 1,200 pedestrian crossings per day per the PBIC), high speed roadways, and high turning movement conflicts. However, pedestrians usually have a long wait for the exclusive signal and may be tempted to cross against the signal, negating the benefits of the exclusive phase. It is also difficult for visually impaired pedestrians who lose the aural cue of traffic moving in one direction or another. The exclusive pedestrian phase increases safety with a crash reduction factor (CRF) of 34 percent, but decreases the efficiency of the intersection (PBIC). Exhibit 5.7 illustrates exclusive timing and the application of a pedestrian scramble at an intersection.
- ***Leading Pedestrian Interval (LPI):*** The walk signal goes on several seconds before the

green traffic signal, allowing pedestrians to enter the crosswalk first, protecting them from turning vehicles and making them more visible to motorists. This technique has been used in New York City successfully for two decades, as well as other cities. LPI is especially good for dual-lane turning movements (PBIC, Crossing Signals), and is also often used in conjunction with "No Right-turn on Red" signs.

Signal timing uses the following intervals:

- Walk (or Walking) Interval
- Pedestrian Change (or Clearance) Interval
- Buffer Interval

Exhibit 5.8 shows the components of signal timing and the prescribed timings in the MUTCD. During the Walk Interval, the static walking person symbol is displayed, typically for seven seconds or more. During the Pedestrian Change Interval, the flashing upraised hand symbol is displayed along with the countdown display. The countdown display is optional only when the Pedestrian Change Interval is seven seconds or less (a rare situation).

The MUTCD states that the Pedestrian Change Interval:

"should be sufficient to allow a pedestrian crossing in the crosswalk who left the curb or shoulder at the end of the Walk Interval to travel at a walking speed of 3.5 feet per second to at least the far side of the traveled way or to a median of sufficient width for pedestrians to wait."*

*This is where a decision using a slower walking speed affects the calculated time. The MUTCD states that a slower walking speed can be used if people who walk more slowly or use wheelchairs

EXHIBIT 5.8 Components of Signal Timing—Pedestrian Intervals

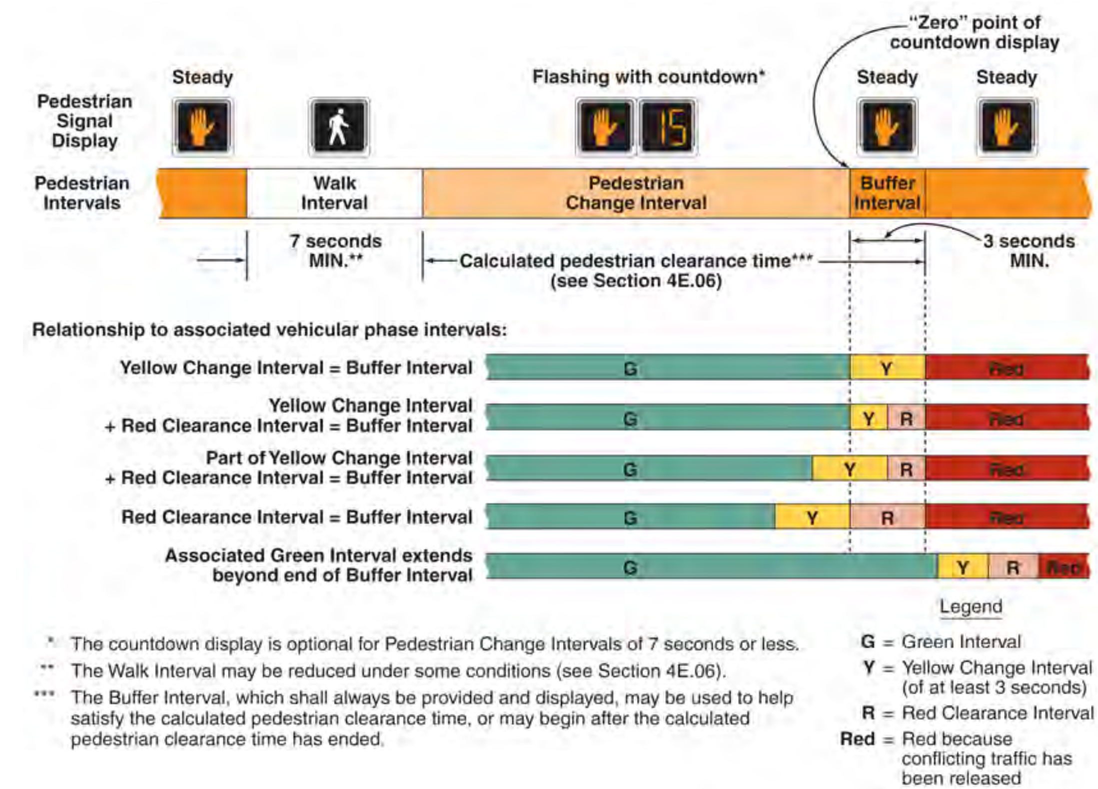


EXHIBIT 5.9 ***Pedestrian Signal Heads:***
PBIC recommends beginning the countdown signal with the Walking Interval Phase.

RAISED HAND:
Don't Walk Signal

WALKING PERSON:
Walking Interval Signal

or

FLASHING HAND WITH COUNTDOWN:
Pedestrian Change Interval

EXHIBIT 5.10 ***Sequence for a Pedestrian Hybrid Beacon***

1. Dark until Activated

2. Flashing Yellow Upon Activation

3. Steady Yellow

4. Steady Red During Pedestrian Walk Interval

5. Alternating Flashing Red During Pedestrian Clearance Interval

6. Dark Again Until Activated

LEGEND

SY - Steady yellow
FY - Flashing yellow
SR - Steady red
FR - Flashing red

"routinely use the crosswalk." This involves engineering judgment. Current research suggests that if more than 20 percent of the people in the pedestrian stream are elderly, a slower walking speed of 3 fps should be used.

The Buffer Interval shall be displayed for at least three seconds prior to the release of any conflicting vehicular movement. The Buffer Interval displays the steady (non-flashing) upraised hand symbol.

The introduction of the countdown display reduces confusion among pedestrians who find themselves in the middle of an intersection and are puzzled by the meaning of the flashing upraised hand sign. However, many existing intersections lack the countdown display and should be retrofitted with them. Countdown signals provide better pedestrian safety. Results from a San Francisco study showed that there was a 25 percent CRF after countdown signals were installed (PBIC). Exhibit 5.9 illustrates pedestrian signal heads, including countdown displays.

Traffic signals are usually timed for vehicle speeds, causing pedestrians to have to stop at nearly every intersection.

OTHER TYPES OF PEDESTRIAN SIGNALS

Pedestrian Hybrid Beacon (HAWK Signal)

A type of signal installation newly recommended in the 2009 MUTCD is designed for unsignalized crossings. It is activated by pedestrians and uses traditional traffic and pedestrian signal heads. It includes a sign instructing motorists to "stop on red" and a "pedestrian crossing" overhead sign. Exhibit 5.10 shows the signal sequence that stops traffic and allows pedestrians to cross a busy street safely.

Pedestrian Actuated Signals

Pedestrian actuated signals may be warranted at non-signalized intersections and mid-block locations where traffic volumes are high, making it difficult for pedestrians to cross.

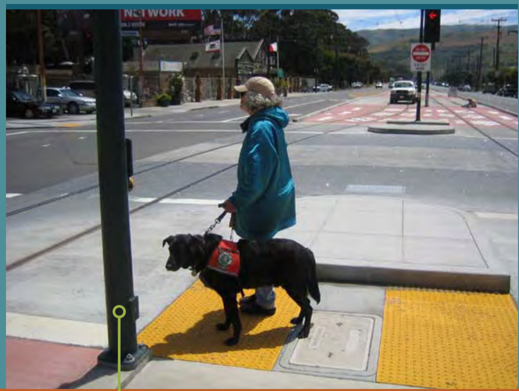
- Active pedestrian actuated signals include a push button device.
- Passive pedestrian actuated signals automatically detect the presence of a pedestrian, and some can track the progress of a pedestrian as they cross the roadway.

Install pedestrian actuated signals at locations where they are recommended by a professional engineering study or warranted by the 2009 MUTCD guidelines. Adequate sight distance is necessary at these locations, and warning signs should be installed in advance of the signal. Pedestrian actuated signals may be appropriate at:

- Intersection crossings where the level of pedestrian activity is low, but the traffic volume and speed of vehicles is high, and/or where gaps in traffic are not adequate to allow pedestrians to cross;
- Mid-block crossings on streets where pedestrian activity is high and the volumes and speeds of vehicular traffic are high; and/or
- Heavily used mid-block bus stops (in which case increased responsiveness of the actuation should be provided during times of peak hour pedestrian access to the bus stop).

Extended Crossing Times

Push buttons that add several seconds to the crossing time can also be provided at intersections. The traffic engineer should determine the time extension, which may be based on slower walking speeds, or the analysis may determine that this application should



Visually impaired pedestrians benefit from audible signals.

Pedestrian push button or actuator

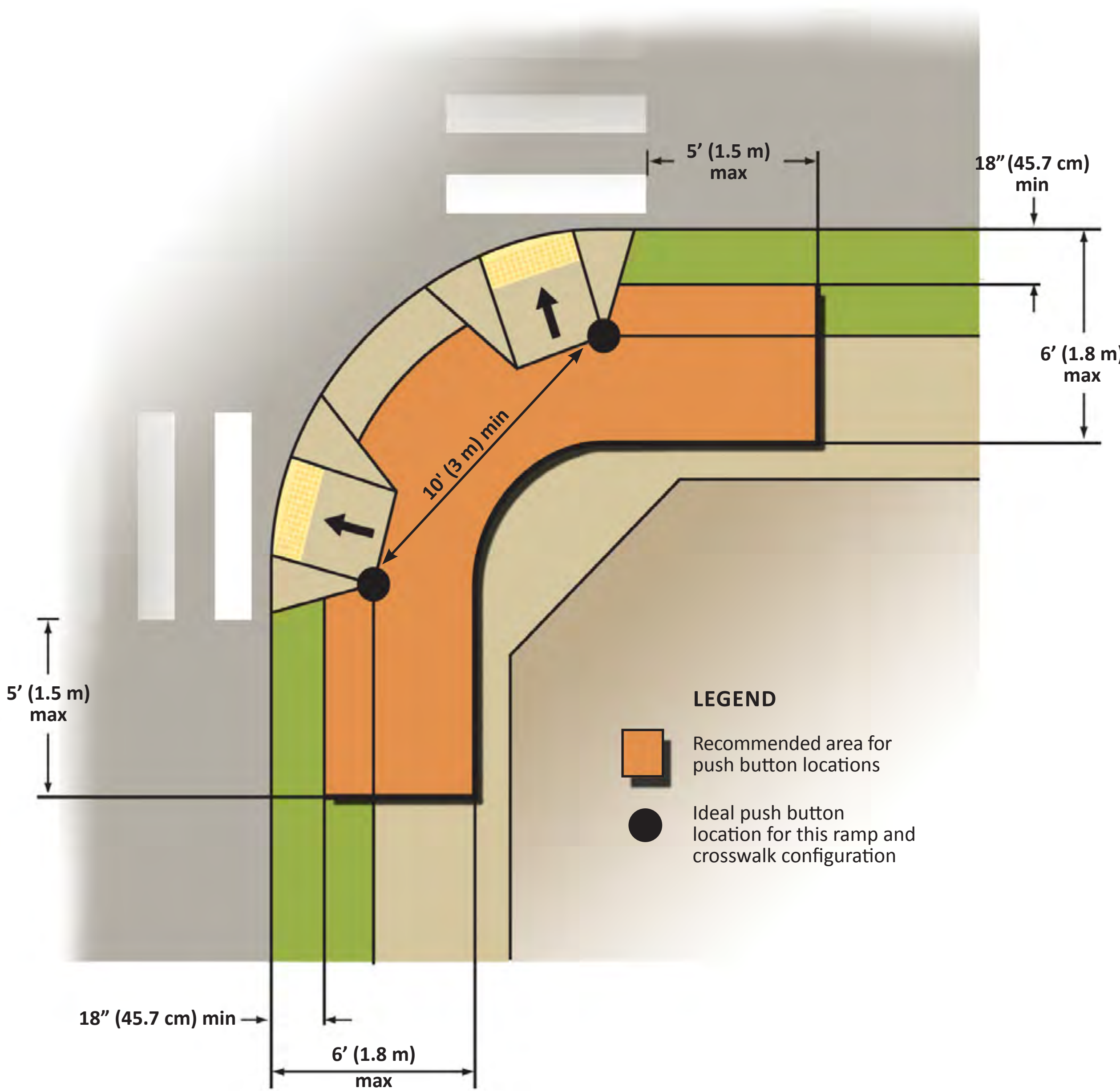
not be installed at the intersection for various reasons, such as major impacts to traffic capacity. (The needs of all intersection users have to be balanced.) Extended crossing times may improve pedestrian safety at:

- Crossings near a hospital, nursing home, retirement home, or other facility that accommodates mobility impaired people;
- Intersections where pedestrian volume varies widely over the course of a day; and
- Other locations as determined through analysis of the context and traffic conditions on a case-by-case basis.

Audible Devices

Audible devices should be considered in areas where a high number of visually impaired pedestrians use the crossing. This may occur near hospitals, retirement homes, or special facilities for the visually impaired. Audible devices should be separated by at least ten feet to avoid confusion about which crossing is open. In some cases it may be wise to include verbal commands to clarify which street to cross. See Toolbox Section 3—Accessibility for additional information.

EXHIBIT 5.11 *Locate push buttons in a convenient place for pedestrians.*



DESIGN AND LOCATION OF PEDESTRIAN SIGNALS

Pedestrian indications and signal heads need to be installed in clearly visible locations from the crosswalk approaches in accordance with the warrants and design guidelines in the 2009 MUTCD. Locate pedestrian push buttons near the end of crosswalks and in easy-to-reach positions. Place them no more than five feet from the pedestrian travel way and face them toward pedestrians. Signs should be mounted on the push-button poles to identify which button to press for each crossing direction. Pedestrian actuators may also be located in pedestrian refuge areas where pedestrians may be caught crossing during the end of the walk cycle. Refer to Exhibit 5.11 for location guidance.

Design and placement of pedestrian actuators should follow the US Access Board Public Rights-of-way Accessibility Guidelines (PROWAG). See Toolbox Section 3—Accessibility for more information.

Pedestrian Related Signs

There are only a few types of pedestrian-related warning signs, creating a clear and simple

***EXHIBIT 5.12** The diamond-shaped pedestrian signs should be combined with other plaques to alert motorists to upcoming pedestrian conditions. See 2009 MUTCD Section 2C-50.*

AT THE CROSSWALK

Note: Diagonal arrow is required at crosswalk if mounted on a post. It may not be used if mounted overhead.

IN ADVANCE OF THE CROSSWALK

message for motorists to follow. The standard, diamond-shaped pedestrian warning sign can be combined with other signs and plaques (such as "XX FEET," or "AHEAD") to give motorists advance warning of an intersection or crossing. Almost all of the pedestrian-related warning signs can use either the standard yellow color, or a yellow-green fluorescent color. Exhibit 5.12 shows some possible sign configurations.

Refer to the 2009 MUTCD for sign design requirements and required distances from crosswalks and intersections. (There are specific signs for trails that cross roadways. Also refer to Toolbox Section 7—Shared Use Paths for more information.)

Other Design Considerations

LIGHTING

Seventy percent of pedestrian fatalities occur at night (NHTSA *Traffic Safety Facts*), so lighting should be a priority at pedestrian crossings. Because pedestrians can easily see a car's lights, they may assume motorists can readily see them. Lighting provides safety, security, and comfort for pedestrians and enhances the ambience of retail and commercial districts

EXHIBIT 5.13 Nighttime Lighting at an Intersection

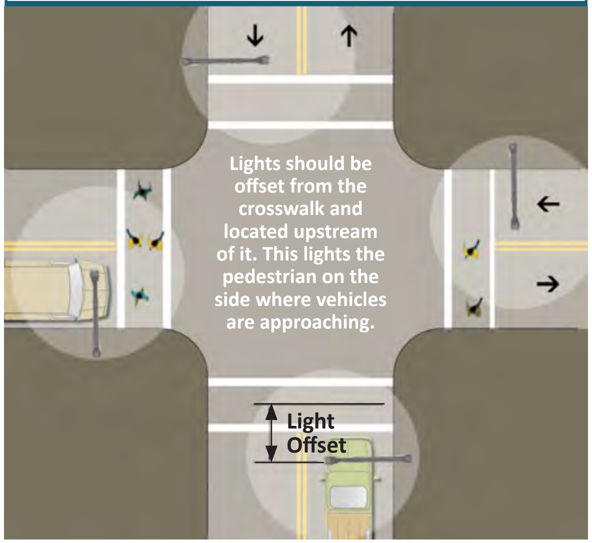
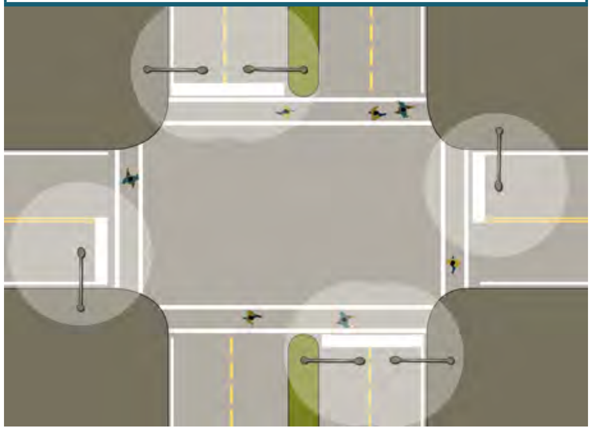


EXHIBIT 5.14 New Lighting for a Wide Roadway



(PBIC). Existing roadway lighting may need to be supplemented with additional pedestrian lighting in areas of heavy pedestrian traffic, at locations where motorists may not expect a crossing, or in other areas determined by a traffic safety analysis or local design priorities.

Crosswalks and the approaches to them should be well lit, with a consistent level of lighting achieved. Overhead road lighting installed at crosswalks generally provides greater visibility distance than headlamps alone. Exhibits 5.13 and 5.14 illustrate lighting guidance for intersections. Preferred types of lighting include light-emitting diode (LED), incandescent, and high-pressure sodium (less expensive). Low pressure sodium has a high level of color distortion (PBIC). LED street lights are more energy efficient than other technologies, and can reduce the cost of keeping streets well-lit when dark.

Refer to the standards and design guidelines of AASHTO, as well as those of the Illuminating Engineering Society of North America. See Toolbox Section 2—Pedestrian-Friendly Streets for more information on lighting.

LOCATION OF DRAINAGE INLETS AND GRATES

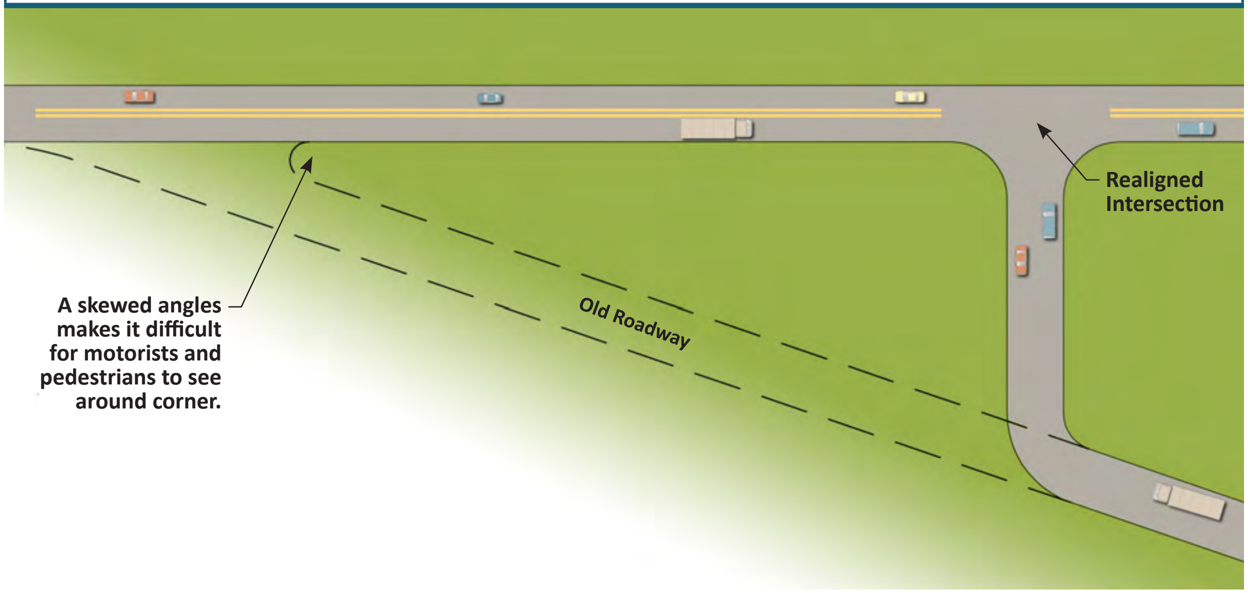
Drainage grates should be located away from crosswalks and curb ramps and outside the route of pedestrian travel. Locate drainage inlets on the upstream side of the crosswalk to avoid excessive drainage flows across the crossing area. Direct road and gutter drainage away from intersection corners and walking areas. This is particularly important given Hawaii's rainfall patterns. The grate tops shall be designed in accordance with PROWAG.

Avoiding or Reconfiguring Multiple and Skewed Intersections

Multiple and skewed intersections should be avoided in all new development. Multiple intersections occur where there are more than four legs or vehicle approaches. They are confusing to pedestrians and motorists alike.

Skewed intersections are created when roadways join at a non-right angle. The acute-angle corner creates poor visibility for both pedestrians and motorists. Intersections where the angle between legs is less than 75 degrees are undesirable, particularly for older pedestrians who may have trouble turning their head to see oncoming traffic.

EXHIBIT 5.15 In rural locations reduced right-of-way costs may make an intersection reconfiguration possible.



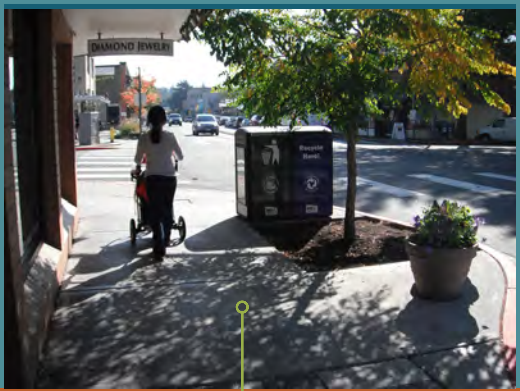
Reconfiguring these types of intersections is expensive because of the need to purchase right-of-way. However, a large scale project may warrant the reconfiguration because the improvement to pedestrian safety increases the value of the project. Exhibit 5.15 shows an example of intersection reconfiguration.

Minimizing Crossing Distances

Minimizing the crossing distance at intersections enables pedestrians to cross the street more safely and comfortably by reducing the time of pedestrian exposure in the street. Design techniques for reducing crossing distances include curb bulb-outs and extensions, median and center refuge islands, right-turn channelization and refuge islands, and use of smaller curb return radii.

Curb Bulb-Outs and Extensions

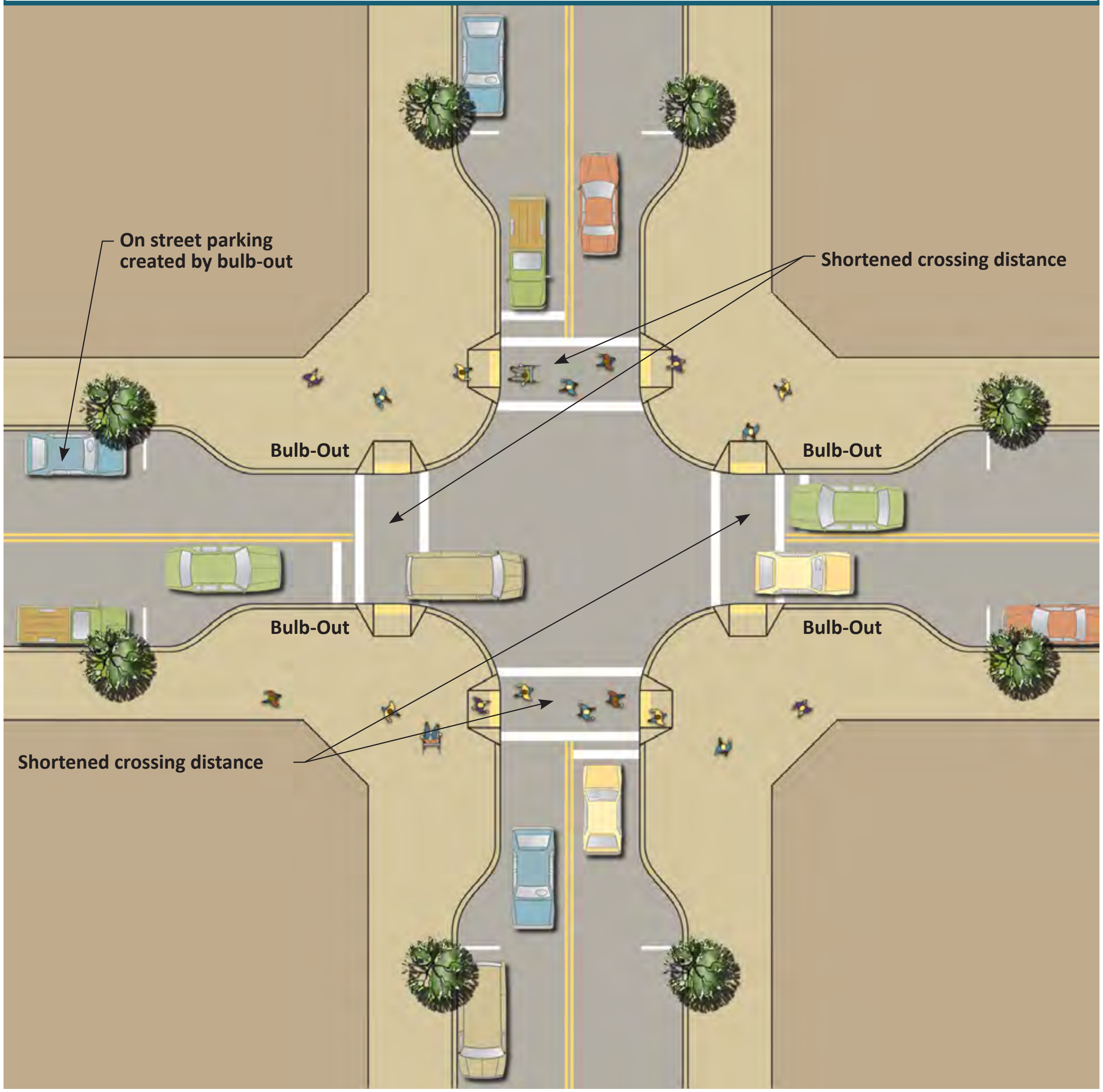
Curb bulb-outs and extensions extend the curb and sidewalk into the street area, shortening crossing distances, reducing the crossing time, and making pedestrians more visible



Bulb out provides space for recycling bins and landscaping, in addition to space at the intersection corner for pedestrians, Kirkland, WA

Bulb out with special sign indicating senior citizens crossing activity, Kirkland, WA

EXHIBIT 5.16 *Corner bulb-outs shorten crossing distances and make pedestrians more visible to motorists.*



to vehicles. At intersection and mid-block crossings, curb bulb-outs and extensions may also help slow traffic by narrowing the street. Curb extensions and bulb-outs can be installed in commercial, residential, and other settings, and they work particularly well:

- At intersections on streets with delineated on-street parking zones
- Where there is limited turning traffic by buses and large vehicles (but can be designed to facilitate large vehicle turning requirements)
- For one-way streets
- As a traffic calming technique

Exhibit 5.16 and 5.17 illustrate curb bulb-outs/ extensions.

Medians and Center Refuge Islands

Medians and refuge islands are curbed areas separating the two directions of traffic movement in the street. They eliminate the need for pedestrians to cross both directions of traffic at once. Whether located at intersections or not, they help define the pedestrian walking space and provide protection and refuge from motor vehicles. Refuge islands are similar in design to raised (curbed) medians, but not as long, typically up to 20 ft (6.1 m). Medians or refuge islands are recommended whenever crossing distances exceed 60 ft (18.3 m) (AASHTO *Guide for the Planning, Design, and Operation of Pedestrian Facilities).*

EXHIBIT 5.17 *Corner bulb-outs put pedestrians into the driver's field of vision.*

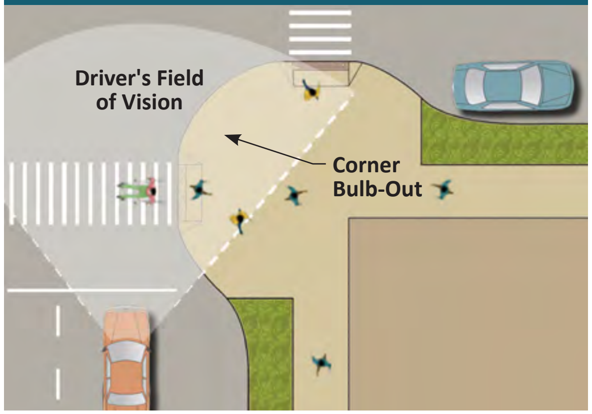
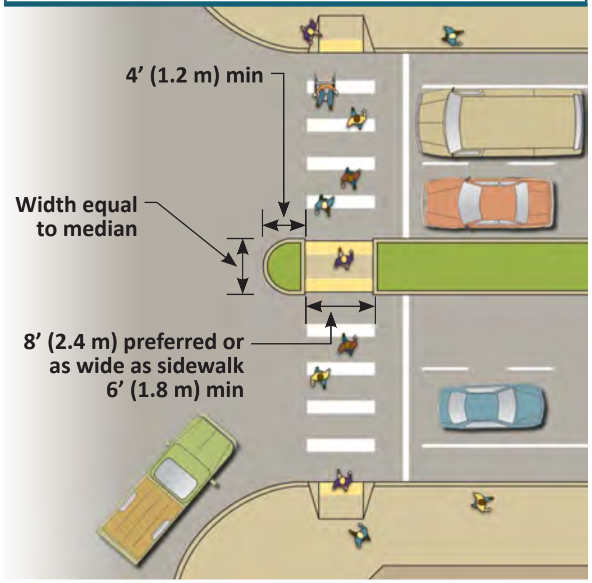


EXHIBIT 5.18 *A median nose added at an intersection crossing provides a refuge for pedestrians, improving their saftety and comfort.*



Because medians control vehicular access and turning movements, they have the ability to isolate traffic flow and increase safety of the roadway. At intersections where there is a median in the roadway, a median nose should be added to create a pedestrian refuge. The refuge should be aligned with the crosswalk, with the nose providing separation from traffic. See Exhibit 5.18.

Medians and center refuge islands need to be wide enough to provide refuge for several pedestrians waiting at once. They preferably should be 8 to 10 ft wide (2.4 to 3 m) and a minimum of 6 ft (1.8 m) in length, measured in the direction of pedestrian travel. The refuge shall be accessible, with either curb ramps or at-grade cuts. The latter are generally easier to construct and easier for pedestrians to negotiate than curb ramps, particularly on smaller islands.

Provide pedestrian push buttons at the refuge when the signal timing doesn't allow all pedestrians to cross the entire street on one crossing phase. Accessible pedestrian signals (APS) shall be provided in accordance with PROWAG.

These areas shall be clear of obstacles such as utilities, including signal control boxes, signal and light poles, signs, and landscaping above two feet in height.

Right-Turn Lanes/Slip Lanes

Ideally, the use of dedicated right-turn lanes and right-turn slip lanes should be minimized, due to the emphasis on easy and fast motor vehicle travel. However, they can be designed to be less problematic. At many arterial street intersections, pedestrians have difficulty crossing due to right-turn movements and wide crossing distances. Well-designed right-turn slip lanes provide pedestrian refuge islands within the intersection and a right-turn lane that optimizes the right-turning motorist's view of the pedestrian. Listed below are four alternatives for design of right-turns, in priority order.

- *Option 1 -* No dedicated right-turn lane; preferred option; see Exhibit 5.19

EXHIBIT 5.19 *No Dedicated Right-Turn Lane*

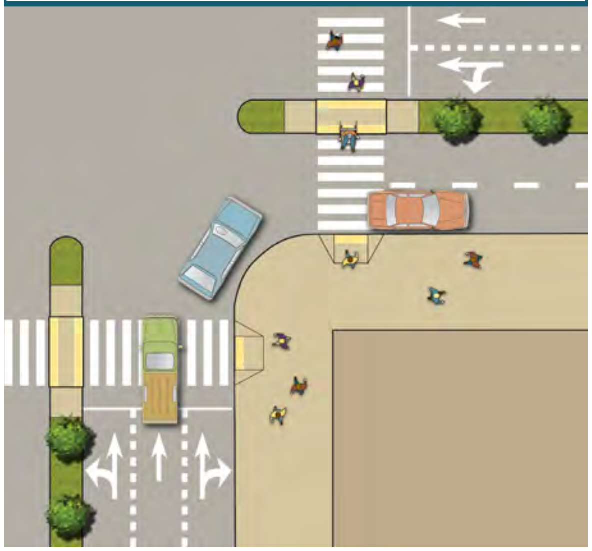


EXHIBIT 5.20 *Dedicated Right-Turn Lane*

EXHIBIT 5.21 *Signalized Right-Turn Slip Lane with Raised Pedestrian Refuge*

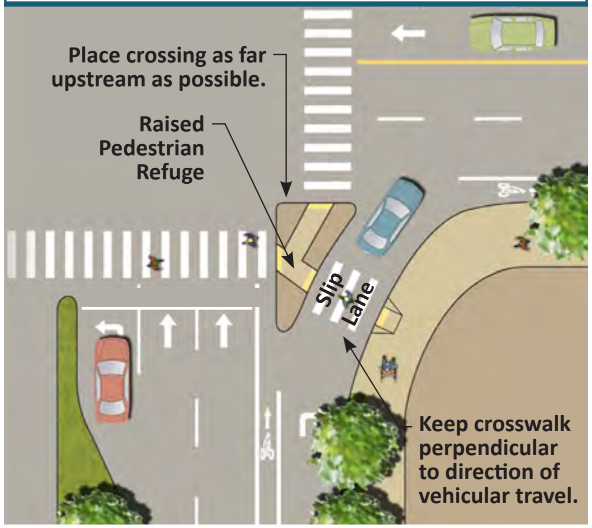


EXHIBIT 5.22 *Yield-Controlled Right-Turn Slip Lane with Raised Pedestrian Crossing*

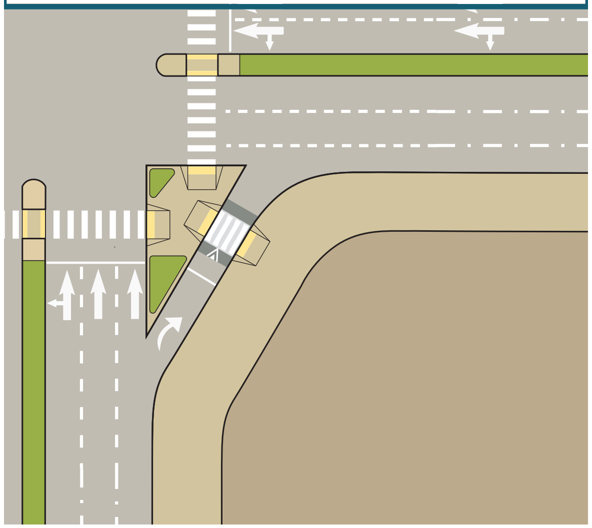
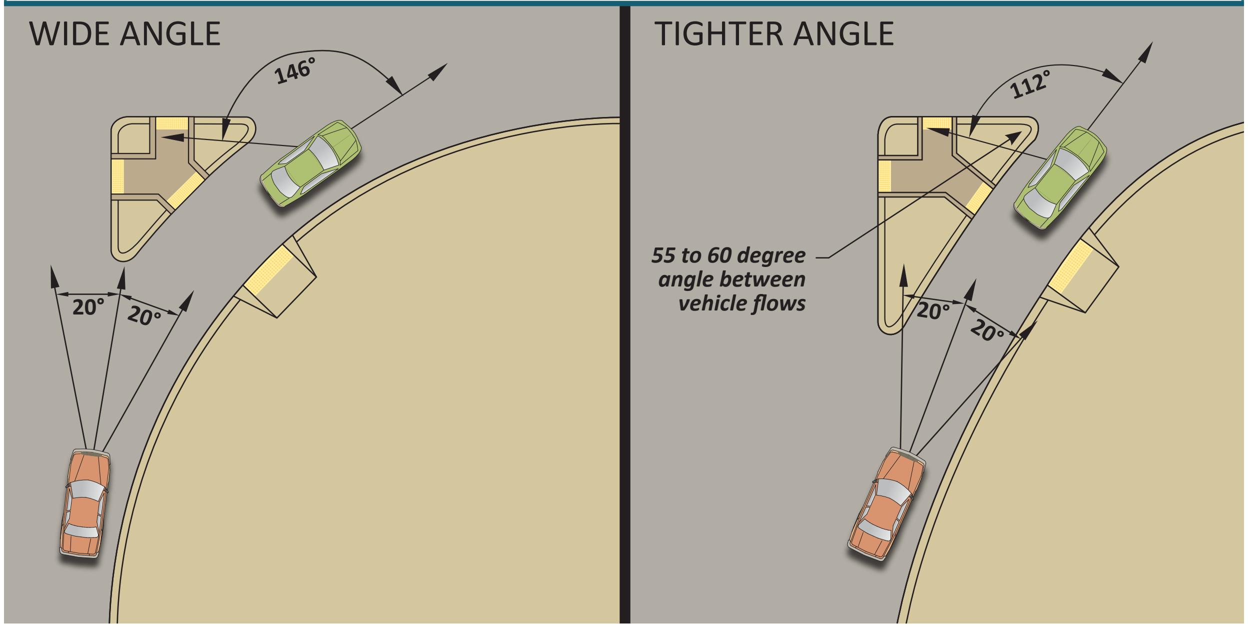


EXHIBIT 5.23 *Preferred Design of a Channelized Right-Turn Lane*
(Kimley Horn and Associates, Inc. adapted from an illustration by Dan Burden)



High speed, low visibility of pedestrians

NOT RECOMMENDED

Vehicle speeds 17 to 18 mph, good visibility of pedestrians

RECOMMENDED

- *Option 2 -* Dedicated right-turn lane; see Exhibit 5.20
- *Option 3 -* Signalized right-turn slip lane with raised pedestrian crossing; see Exhibit 5.21
- *Option 4 -* Yield-controlled right-turn slip lane with raised pedestrian crossing; see Exhibit 5.22

The provision of a channelized right-turn lane is appropriate only on signalized approaches where right-turning volumes are high or large vehicles frequently turn and conflicting pedestrian volumes are low and are not expected to increase greatly.

The design of a channelized right turn and refuge island should follow the recommended approach in Exhibit 5.23. The exhibit depicts two designs of a channelized right-turn lane. The first shows a wide angle design with a high-speed, low visibility of pedestrians with a 20 degree to 142 degree angle. The second design shows a tighter angle showing a 20 degree to 112 degree angle, with a 55 to 60 degree angle between vehicle flows. Historically, channelized right-turns were often designed like the first example, which is no longer a recommended practice. The preferred design uses an approach angle that lowers speeds and improves visibility.

When channelized right-turn lanes are justified for traffic capacity or large vehicle purposes, the following practices should be used:

- Provide a low-angle right turn (about 112 degrees). This angle slows down the speed of right-turning vehicles and improves driver visibility of pedestrians within and approaching the crosswalk (as shown in Exhibit 5.23).
- Place crosswalks so that a motorist has a clear view of pedestrians.

- Unless the turning radii of large vehicles, such as tractor-trailers or buses must be accommodated, the pavement in the channelized right-turn lane should be no wider than 16 feet. For any width right-turn lane, mark edge lines and cross-hatching to restrict the painted width of the travel way of the channelized right-turn lane to 12 ft (3.6 m) to slow smaller vehicles.
- If vehicle-pedestrian conflicts are a significant problem in the channelized right-turn lane, it might be appropriate to provide signing to remind drivers of their legal obligation to yield to pedestrians crossing the lane in the marked crosswalk. Regulatory signs such as the TURNING TRAFFIC MUST YIELD TO PEDESTRIANS (R10-15) or warning signs such as the PEDESTRIAN CROSSING (W11-2) could be placed in advance of or at the crossing location.

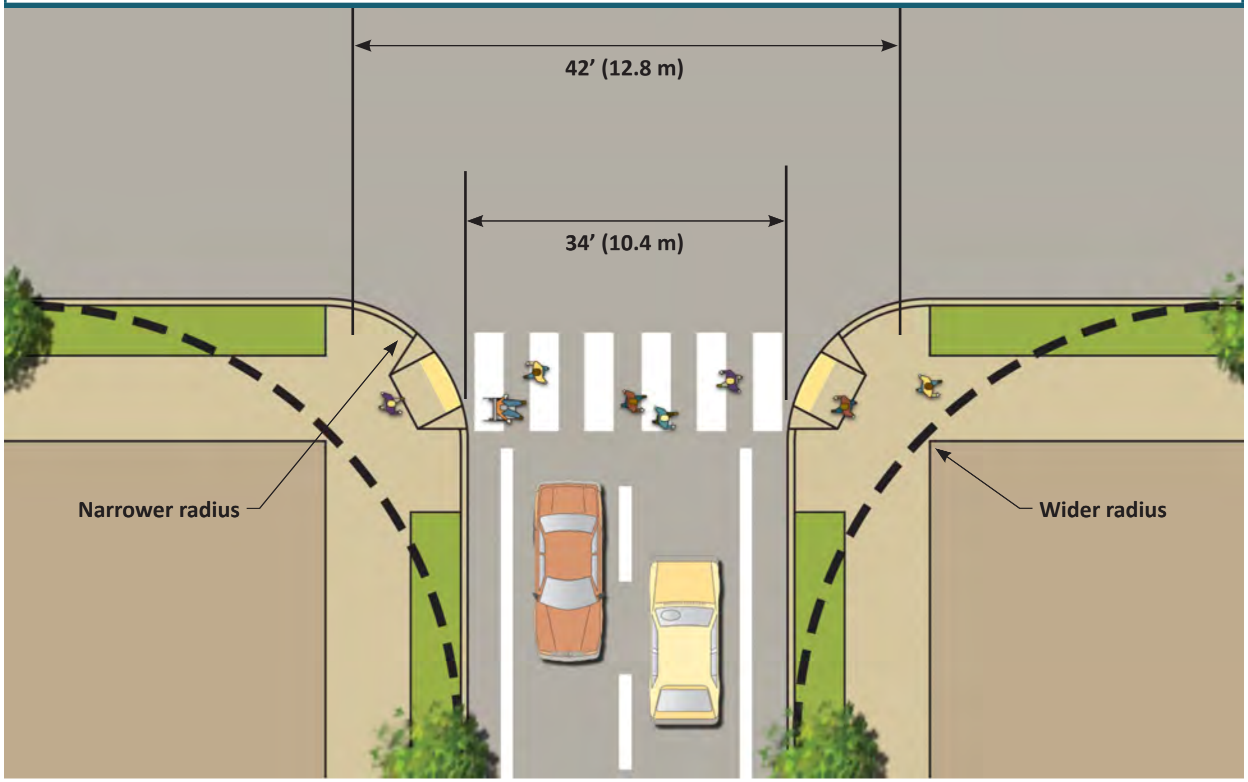
At locations with extremely high numbers of right-turning movements, slip lanes should be equipped with a signal to provide pedestrians opportunities to cross. See previous discussion in this section pertaining to signalization.

Curb Return Radius

The use of smaller curb return radii at intersections reduces pedestrian crossing distances. Reduced radii also help to slow vehicles as they navigate through their turning movement, enabling drivers to respond more quickly to signal changes and crossing pedestrians. Exhibit 5.28 compares the crossing distance between two 15 ft (4.6 m) radius corners and two 30 ft (9.1 m) radius corners at an intersection.

As shown in Exhibit 5.24, the smallest practical curb-return radii should be used to shorten the length of the pedestrian crosswalks. The primary benefits of smaller curb-return radii to pedestrians in urban areas include:

EXHIBIT 5.24 ***Reducing curb radii can shorten crossing distances substantially.***

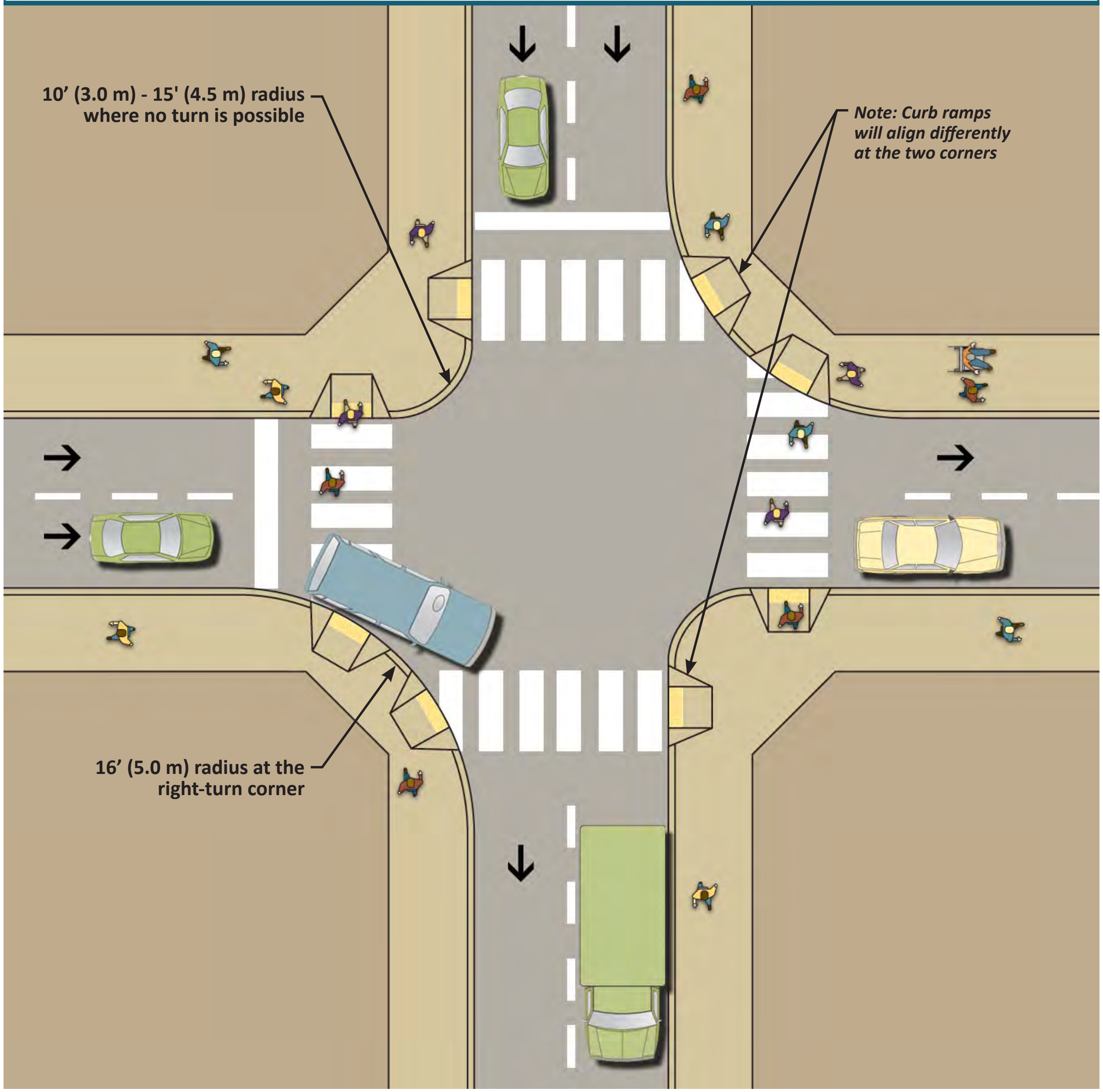


- Increasing motorist visibility of pedestrians waiting to cross the street;
- Reducing pedestrian crossing distance (which also benefits vehicles with a shorter cycle length at signalized intersections) and exposure to traffic;
- Providing the shortest accessible route for people with disabilities; and
- Reducing speed of turning vehicles and as such, the potential severity of crashes.

Intersections designed for the largest turning vehicle traveling at significant speeds with no encroachment result in long pedestrian crossings and potentially high-conflict areas for pedestrians and bicyclists. Radii designed to accommodate the occasional large vehicle will allow passenger cars to turn at high speeds. Curb return radii ranging from 5 to 25 ft (1.5 to 7.6 m) are preferable for walkable areas to shorten pedestrian crossings and slow vehicle-turning speeds, which increase safety for all users.

In town centers and downtowns where pedestrian activity is intensive, curb-return

EXHIBIT 5.25 ***One Way Streets with Smaller Curb Return Radii at Non-Turning Corners***



radii should be as small as possible. On multi-lane streets and roadways, large vehicles may encroach into the adjacent travel lanes (in the same direction of travel) when turning. Curb-return radii of different lengths can be used on different corners of the same intersection to match the design vehicle turning at that corner. On one way streets there is an opportunity to shorten the radii of the corners where vehicles do not turn, as shown in Exhibit 5.25.

At intersections with no vehicle turns, the minimum curb return radii should be 5 ft (1.5 m). A curb return radius of 5 to 15 ft (1.5 to 4.5 m) should be used where:

1. High pedestrian volumes are present or reasonably anticipated;
2. Volumes of turning vehicles are low;
3. The width of the receiving intersection approach can accommodate a turning passenger vehicle without encroachment into the opposing lane;
4. Large vehicles constitute a very low proportion of the turning vehicles;
5. Bicycle and parking lanes create additional space to accommodate the "effective" turning radius of vehicles;
6. Low turning speeds are required or desired; and
7. Occasional encroachment of turning school bus, moving van, fire truck, or oversized delivery truck into an opposing lane is acceptable.

Curb radii may need to be larger where:

1. Occasional encroachment of a turning bus, school bus, moving van, fire truck, or oversized delivery truck into the opposing lane is not acceptable;
2. Curb extensions are proposed or might be added in the future; and
3. Receiving thoroughfare does not have parking or bicycle lanes and the receiving lane is less than 12 ft (3.6 m) in width.

An alternative to increasing curb-return radii is setting back the stop line of the receiving street to allow large vehicles to swing into opposing lane as they turn. Setbacks to accommodate right-turn encroachment need to be examined on a case-by-case basis since very tight right turns may require long setbacks.

KEEP THE CROSSING DISTANCE AS SHORT AS POSSIBLE

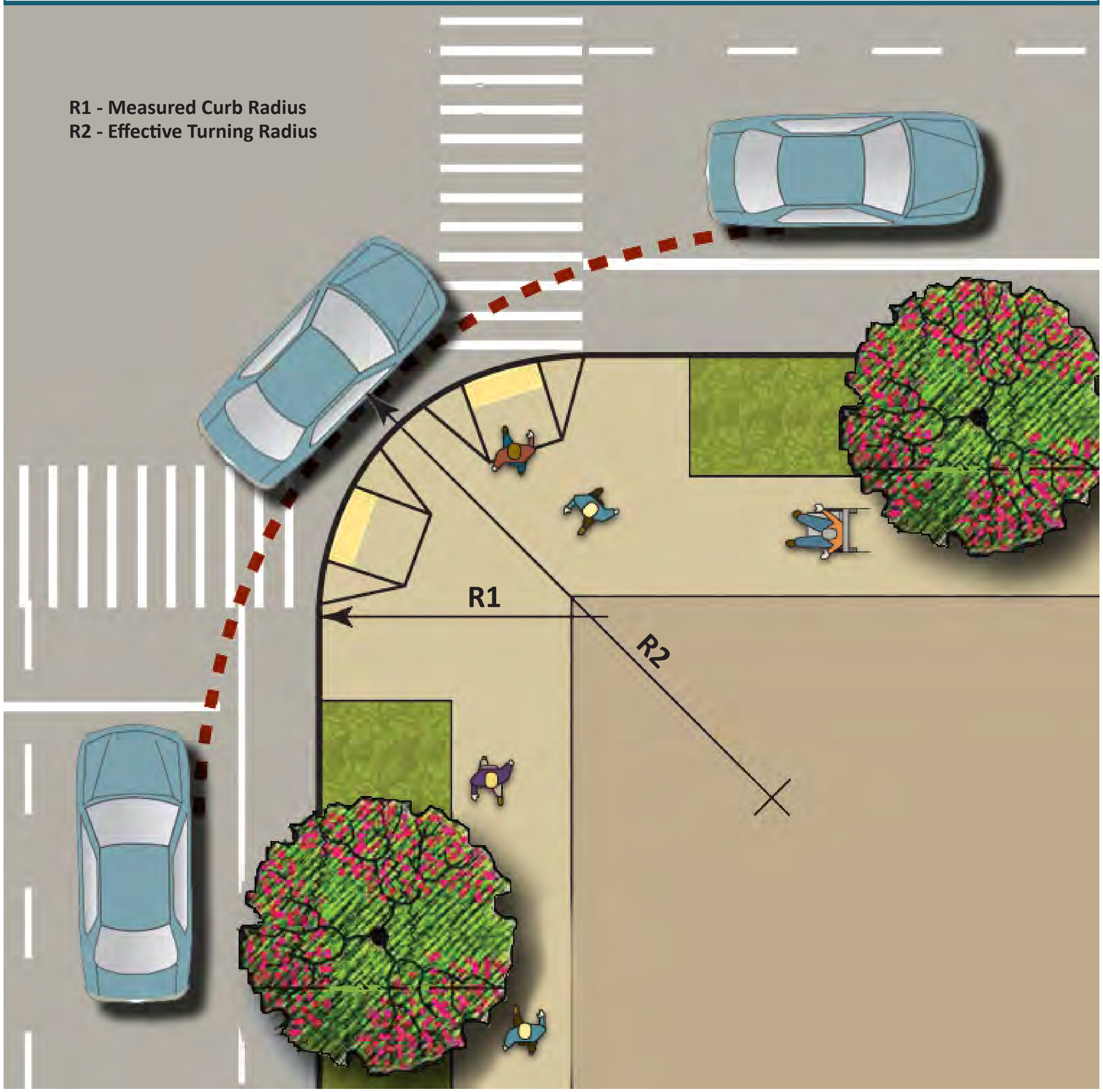
In walkable areas, the first consideration is keeping crossing distance as short as possible. Consider alternatives to lengthening the curb radius first, then consider lengthening the radius if no other alternative exists.

Source: Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, Institute of Transportation Engineers

RECOMMENDATIONS FOR TRUCK ROUTES

Truck routes should be designated outside of or on a minimum number of streets in walkable areas to reduce the impact of large turning radii. Where designated truck routes

EXHIBIT 5.26 Effective turning radius is larger than curb radius.



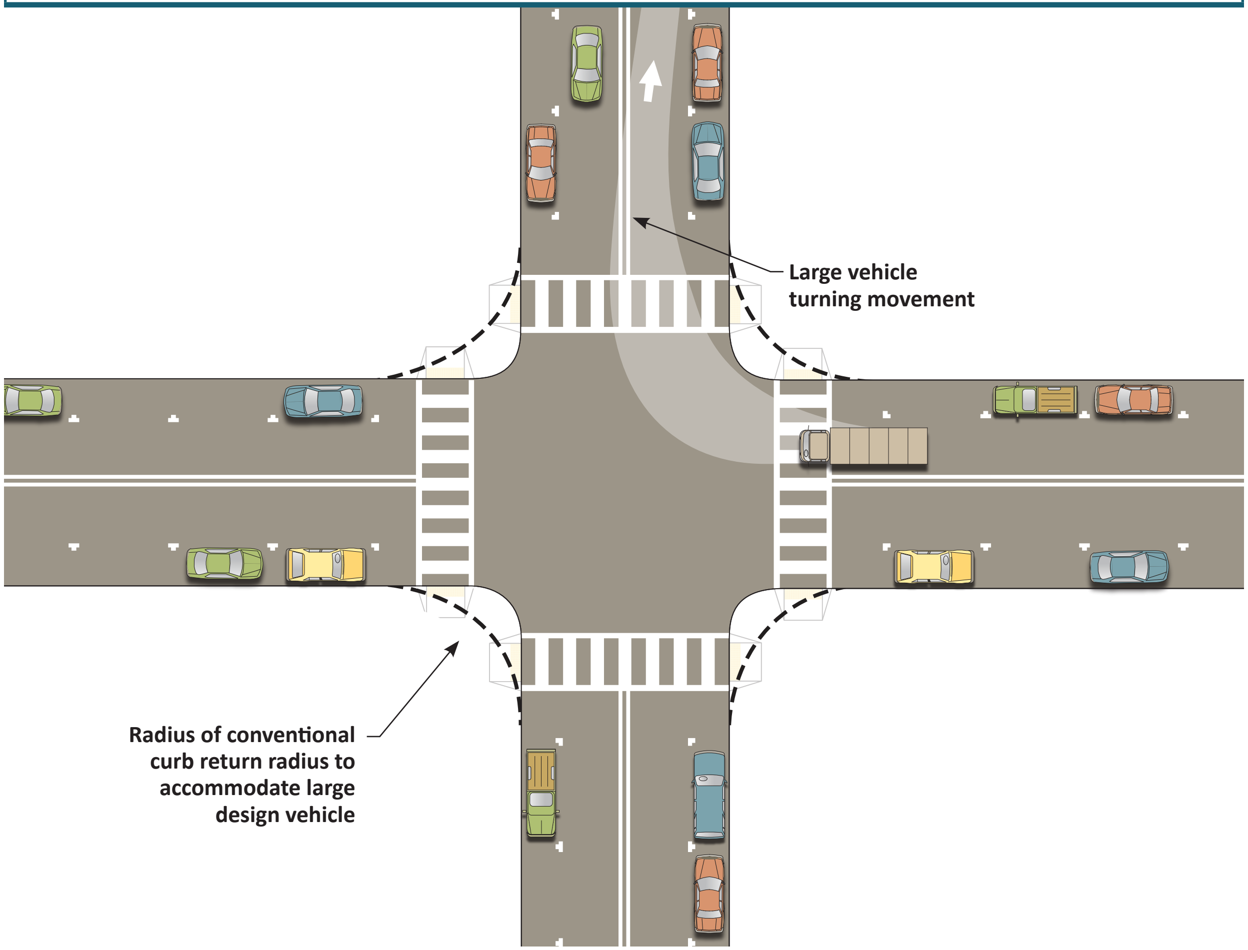
conflict with heavy pedestrian activity, analyze freight movement needs and consider redesignation of truck routes to minimize conflicts. On bus and truck routes, the following guidelines should be considered:

- Curb-return radii design should be based on the effective turning radius of the prevailing design vehicle. Refer to Exhibit 5.26.
- Where the potential for conflicts with pedestrians is high and large vehicle turning movements necessitate curb radii exceeding 50 ft (15.2 m), consider installation of a channelized right-turn lane with a pedestrian refuge island (see discussion earlier in this section).
- Where frequent turning of large vehicles takes place, avoid inadequate curb-return radii as they could potentially cause large vehicles to regularly travel across the curb and into the pedestrian waiting area.

CONSIDERING THE EFFECTIVE TURNING RADIUS

Curb-return radii should be designed to reflect the "effective" turning radius of the corner. The effective turning radius takes into account the wheel tracking of the design vehicle utilizing the width of parking and bicycle lanes. The existence of parking and bicycle lanes creates an "effective" turning radius that is greater than the curb-return radius, as shown in Exhibit 5.26. The use of the effective turning radius allows a smaller curb-return radius while also accommodating larger vehicles. Smaller curb-return radii shorten the distance that pedestrians must cross at intersections. In many cases, the occasional turn made by large trucks can be accommodated with slower speeds and some minimal encroachment into the opposing traffic lanes as shown in Exhibit 5.27.

EXHIBIT 5.27 ***Large Vehicle Turning Movement Adjacent to Shorter Curb Return Radius***
(Kimley Horn and Associates, Inc.)



Mid-Block Crossings

Over 75 percent of pedestrian fatalities occur at mid-block crossings (NHTSA *Traffic Safety Facts*), so the need for well designed, safe crossings at these locations is high. In areas where distances between intersections are long, crossings can provide pedestrians opportunities to cross.

A mid-block crossing may be appropriate wherever pedestrian activity is high, such as between an apartment site and a grocery store; a school and park; or a transit stop and a residential neighborhood.

Determining the Need for Mid-Block Crossings

Locations being considered for mid-block corssings need to be carefully studied. Mid-block crossings should be installed on the basis of a

EXHIBIT 5.28 ***Where and Where Not to Locate Mid-Block Crossings***

LOCATE MID-BLOCK CROSSINGS

- Where significant pedestrian crossings and substantial pedestrian/vehicle conflicts exist; should not be used indiscriminately.
- Where the crossing can serve to concentrate or channelize multiple pedestrian crossings to a single location.
- At approved school crossings or crossings on recommended safe routes to schools.
- Where land uses create high concentrations of pedestrians needing to cross (such as residential areas across from retail or recreation, and transit stops across from residential or employment).
- Where pedestrians could not otherwise recognize the proper place to cross or there is a need to delineate the optimal location to cross.

AVOID LOCATING MID-BLOCK CROSSINGS

- Mid-block crosswalks should generally be avoided under the following circumstances (unless they are stop controlled):
  - Immediately downstream (less than 300 feet) from a traffic signal or bus stop where motorists are not expecting pedestrians to cross (Knoblauch et. al.);
  - Within 600 feet of another crossing point (Knoblauch et. al.), except in central business districts or other locations where there is a well-defined need. The recommended minimum separation is 300 feet;
  - On multi-lane streets with no refuge; and
  - On streets with speed limits above 45 mph.

thorough engineering analysis if they are not located at an existing stop sign, yield sign, or traffic signal. Guidance for determining locations for mid-block crossing installation is provided by the ITE manual, *Design and Safety of Pedestrian Facilities* and summarized in Exhibit 5.28.

Design of Mid-Block Crossings

Design treatments at mid-block crossings are generally most effective when used in combinations (e.g. marked crosswalks and signs). As noted above in the section on Crosswalk Markings, the presence of markings on four-lane roads with an ADT of 12,000 or more and no other pedestrian improvements has been associated with a higher level of crashes, if no other treatments, such as signs, flashing lights, signals, etc. are also provided. For this reason, design treatments should normally be used in combination at mid-block crossings. These may include:

New mid-block crossing in a busy commercial area, designed with flashing signs and high contrast crossing area, Downtown Bellevue, WA

Unsignalized mid-block crossing on a lower volume local street in a residential area, Bellevue, WA

- Markings
- Stop or yield signs
- Signalization
- Pedestrian hybrid beacons
- Pedestrian actuated buttons
- Refuge islands
- Curb extensions
- Signs (sometimes with flashing lights) warning motorists of the presence of pedestrians

Crossing design treatments and related traffic control require careful consideration and a traffic engineering analysis of existing conditions on a project-by-project basis. Exhibits 5.29 and 5.30 illustrate mid-block crossings on two types of streets.

Mid-block crossings should be located where there is adequate sight distance for both the motorist and pedestrian. In addition to proper roadway geometry, any obstacle that would interfere with visibility at the crossing location (e.g. mailboxes, utility poles, street furniture,

EXHIBIT 5.29 *Curb extensions create space for on-street parking and shorten crossing distances for pedestrians.*

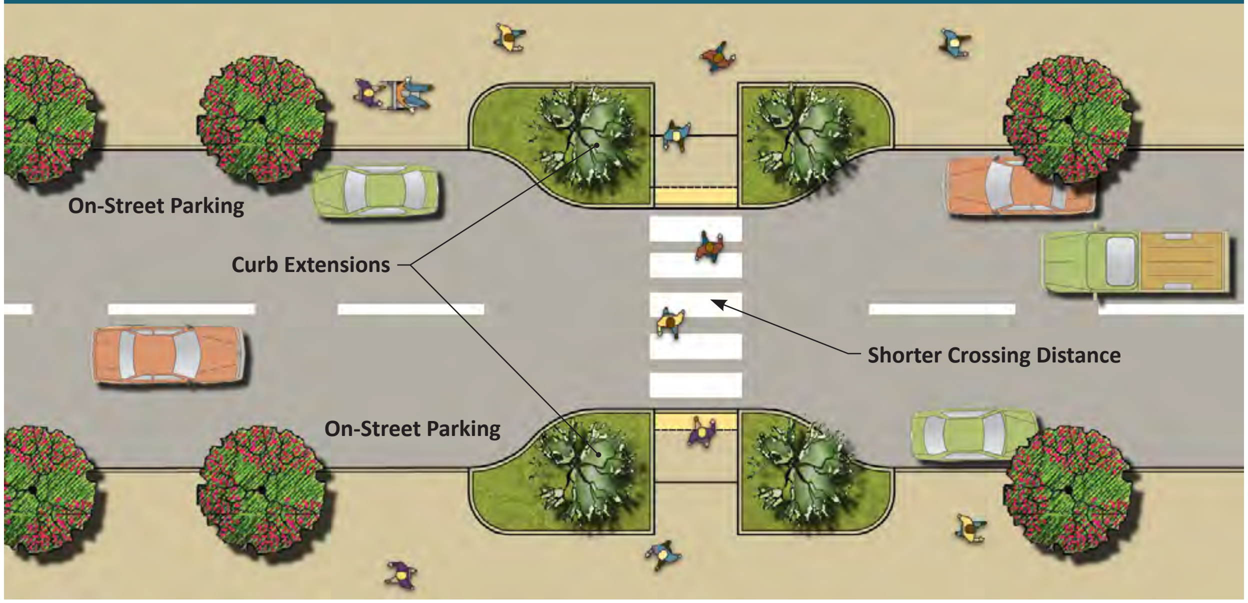
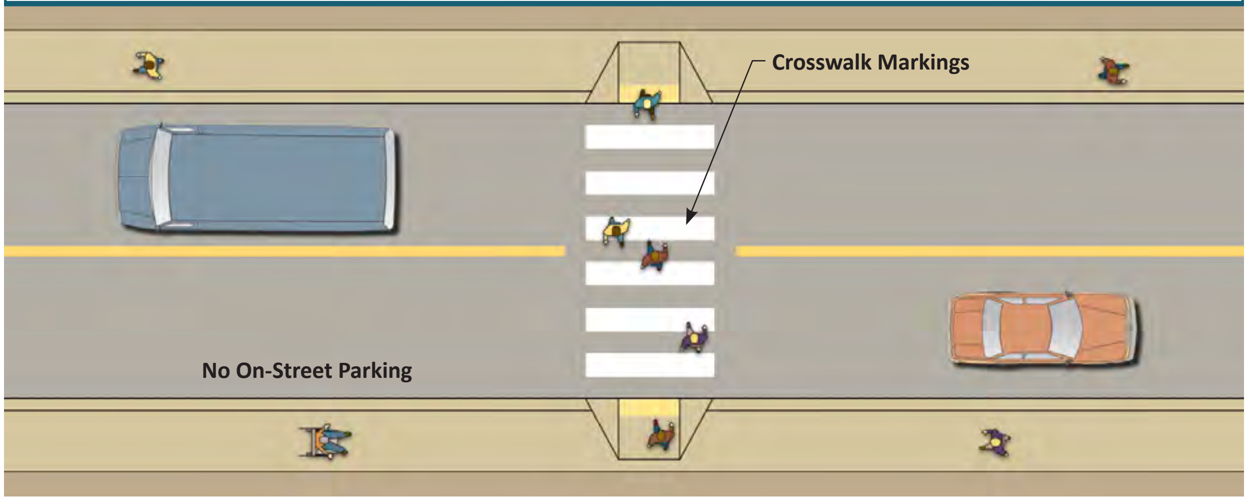


EXHIBIT 5.30 *Pedestrians have the right-of-way in marked mid-block crossings.*



landscaping, etc.) should be removed or relocated. On-street parking should be set back from the crossing point for improved visibility. See Exhibit 2.5 in Toolbox Section 2—Pedestrian-Friendly Streets for setback dimensions.

REFUGE ISLANDS AT MID-BLOCK CROSSINGS

Raised refuge islands greatly increase pedestrian safety at mid-block crossings. They can be installed by themselves or within a median. On multi-lane roads, raised medians or refuge islands are highly recommended because they greatly increase pedestrian safety. Exhibit 5.31 summarizes design guidelines for medians and refuge islands. Exhibit 5.32 lists locations where median refuge islands are most beneficial.

The refuge islands should be raised to provide a vertical barrier and added protection between vehicles and pedestrians. Refuge islands need to provide curb cuts or cut-throughs for accessible passage. Minimum dimensions for refuge islands as required by AASHTO are:

- Area no smaller than 54 sq ft (5 sq m), but preferably a minimum of 97 sq ft (9 sq m).
- Minimum length of 20 to 25 ft long (6.1 m to 7.6 m)
- A wider area is needed to provide curb ramps and a level area between the curb ramps in the crossing region.
- Medians and pedestrian refuge islands shall be 6 ft (1.8 m) minimum in length in the direction of pedestrian travel. The crossing refuge island shall contain a pedestrian access route of 4 ft (1.2 m) width minimum (PROWAG).

EXHIBIT 5.31 Design Guidelines for Medians and Refuge Islands

Medians and refuge islands should ideally be 8 to 10 ft wide (2.4 to 3 m) and a minimum of 6 ft (1.8m) in length, measured the direction of pedestrian travel. This prevents wheelchairs propelled by attendants, bicyclists, and people with strollers from projecting out into traffic lanes.
In order to obtain appropriate median width, travel lanes can be narrowed to 11 ft (3.3 m), if approved by the appropriate review agency. Where vehicle speeds range from 20 to 30 mph (32 kph to 48 kph), the travel lanes can be reduced further to 10 or 9 ft (3 m to 2.7 m), if approved by the appropriate review agency.
Trees in medians and at the sides of streets can help to narrow the field of vision for approaching drivers, causing them to slow down as they near the crossing point. Landscaping in median refuge islands must be placed carefully. It is essential that landscaping not block the sight lines of pedestrians and motorists at the crossing area.
Cut-throughs or curb ramps should be installed in all median refuge islands. Cut-throughs are more common because the median width is rarely large enough to accommodate ramps that meet the ADA requirements. Cut-throughs should be designed with a 2 percent cross slope for drainage. Truncated domes should be installed as a warning device for visually impaired pedestrians.
A pedestrian push button should be placed in the median of signalized mid-block crossings where the crossing distance exceeds 60 ft (18.2 m). Provide APS per PROWAG.
The use of angled (45 degrees+) refuge areas/cut throughs in the island is recommended to direct the pedestrian to look toward oncoming traffic, helping them to be more aware of approaching vehicles.
Medians and refuge islands should be illuminated.

Sources: AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, WSDOT Pedestrian Facilities Guidebook.

Colorful stencil complements high contrast white lines of the crosswalk.

The crossing area is angled to orient pedestrians to the view of oncoming traffic.

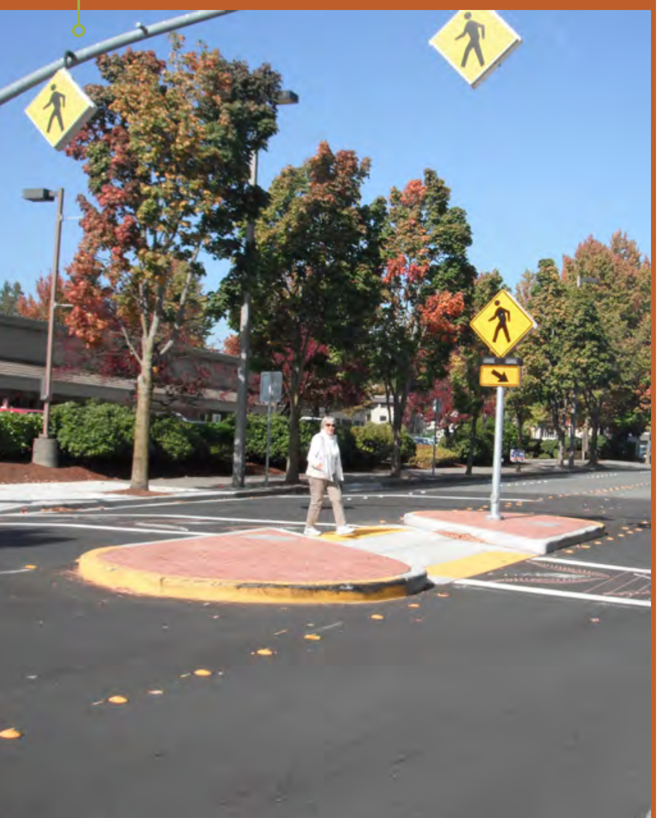
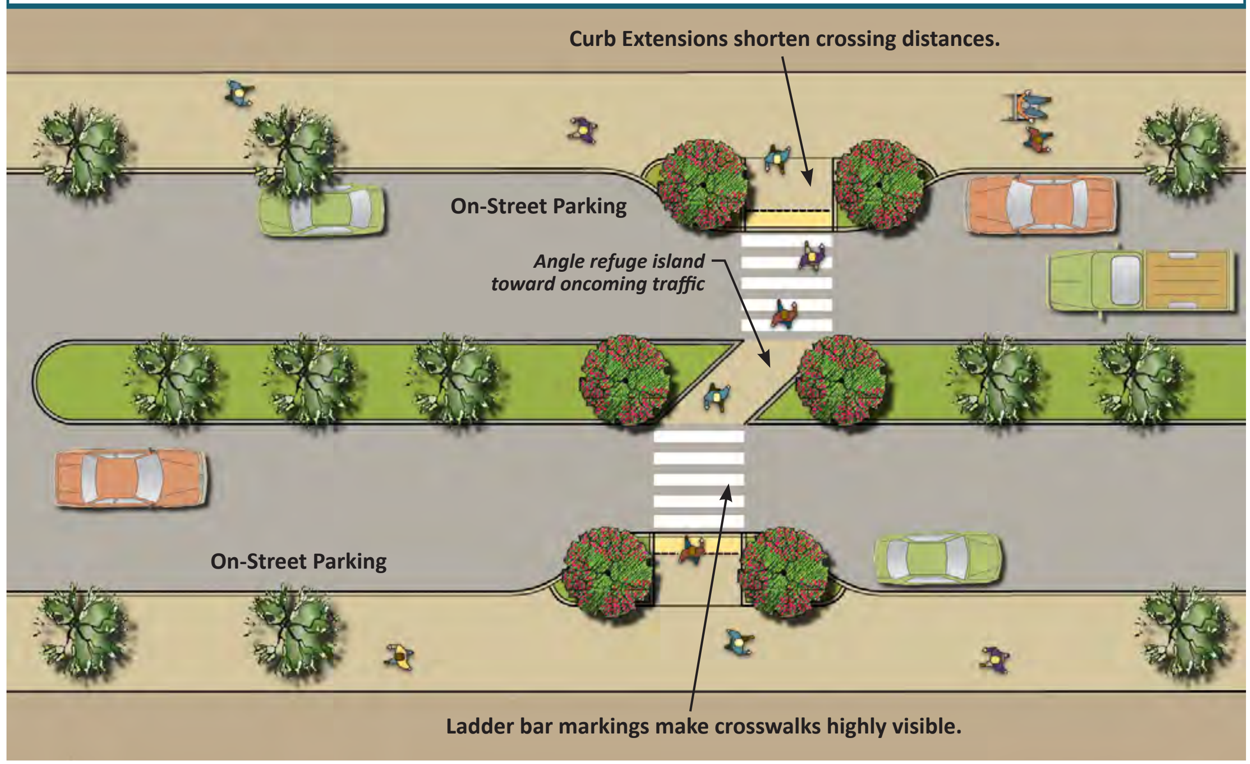


EXHIBIT 5.32 Locations Where Refuge Islands are Most Beneficial

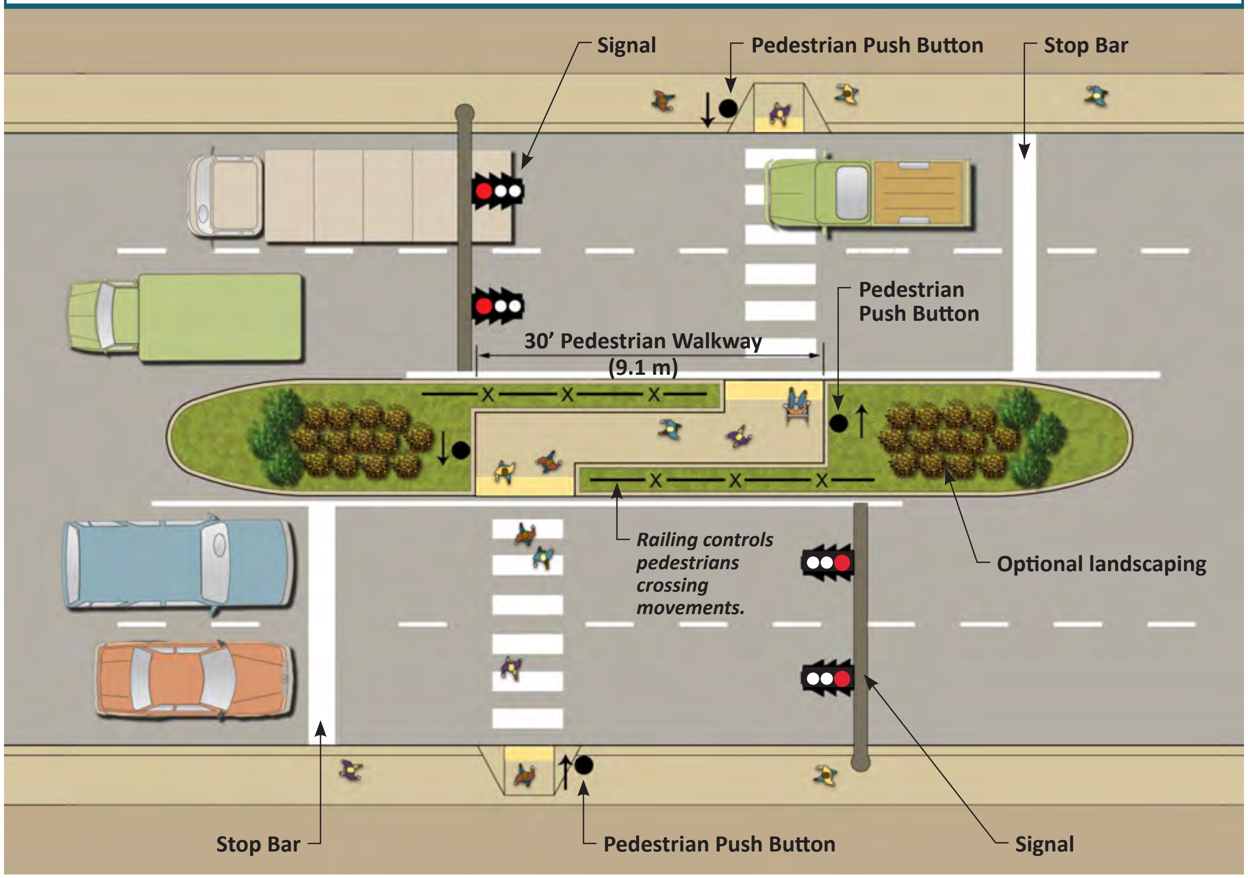
Wide, two-way streets (four lanes or more) with high traffic volumes, high travel speeds and large pedestrian volumes.
Wide streets where children, people with disabilities, or older adults cross regularly.
Wide, two-way intersections with high traffic volumes and significant numbers of crossing pedestrians.
Local and side streets where traffic volumes and flows create insufficient time to cross.
Minor access/local residential streets where they function both as traffic calming devices and street crossing aids.

EXHIBIT 5.33 Medians create a natural place to provide a pedestrian refuge island in mid-block.



A raised refuge island with a cut through in a "Z" form is the best practice as shown in Exhibit 5.33. It offsets the crosswalk so pedestrians will be oriented towards oncoming traffic. A walkway between split crossings can also be provided, as shown in Exhibit 5.34. This approach provides space for pedestrians waiting to cross, and it also forces the pedestrian to view oncoming traffic as they walk from one crossing point to the next. Railing can be installed to control pedestrian crossing movements.

EXHIBIT 5.34 A Well Designed Pedestrian Refuge at a Fully-Signalized Mid-Block Crossing



RAISED MID-BLOCK CROSSINGS

Raising a crossing to the same level as the curb enhances pedestrian safety by making pedestrians more visible and by functioning as a speed hump or speed table, which forces motorists to slow down. They provide additional comfort to the pedestrian by maintaining the grade from curb to curb. Raised crossings should be accompanied by the appropriate roadway markings as shown on Exhibit 5.35. Advance speed hump markings are designed to warn motorists of the upcoming speed hump and may help alert them to the presence of pedestrians as well.

Signalization and Signs at Mid-Block Crossings

Mid-block crossings may be signalized, unsignalized, or use other techniques described in this section to control roadway traffic. Signalization should be designed and installed only on the basis of a professional engineering study.

Exhibit 5.36 lists suggested traffic control treatments for pedestrian crossings of four or more lanes on streets and roadways. These suggestions also apply to shared use paths.

EXHIBIT 5.35 *Speed humps can double as crossings and should be marked with crosswalk markings and speed hump markings.*

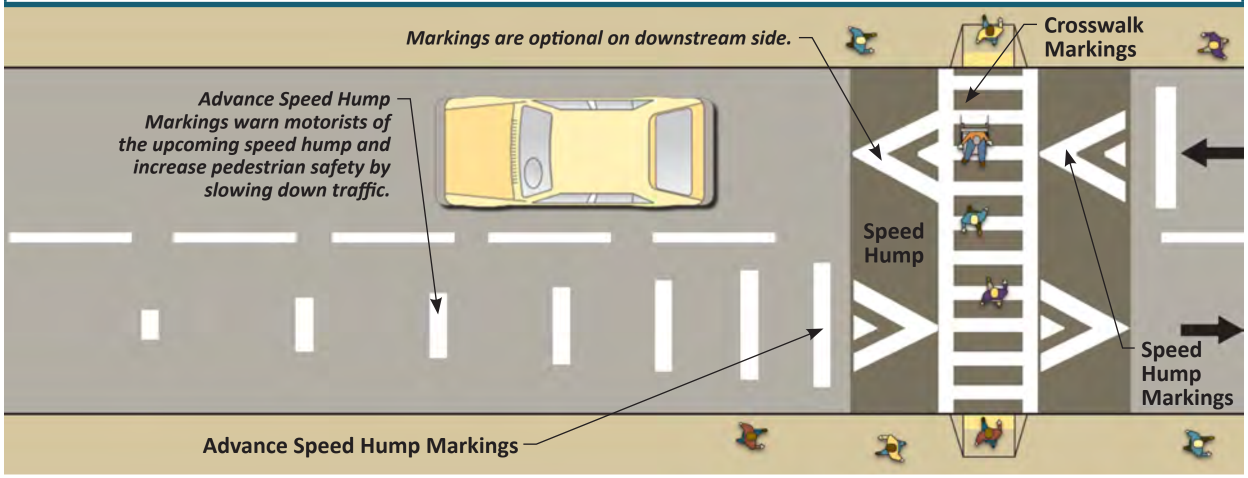


EXHIBIT 5.36 *Suggested Traffic Control Treatments on Four (or More) Lane Road Crossings*

SPEED OF AVG DAILY TRAFFIC ON ROADWAY (85%)	<10,000 ADT	10,000-19,999 ADT	20,000+ ADT
<=35 mph (60 kph)	Refuge area, preferably protected	Protected Refuge or Signal	Signal or grade separated
>=40 mph (65 kph)	Protected Refuge or Signal	Signal	Signal or grade separated

Source: Florida Pedestrian Planning and Design Handbook

MID-BLOCK PEDESTRIAN ACTUATED SIGNALS

Pedestrian actuated signals are often appropriate for roadways that have high traffic volumes or speeds, or four or more lanes. Since these signals only operate in the presence of pedestrian traffic, they do not cause undue delay to vehicles during periods of low pedestrian volumes. A signal warrant analysis should be performed to study specific conditions and determine if a pedestrian actuated signal should be installed. See the previous discussion in this section on pedestrian actuated signals.

WARNING BEACONS

Flashing yellow lights may be used at mid-block crossings to warn motorists of the presence of pedestrians. Two flashing lights can be paired together to flash alternately or simultaneously. They may not be used in the absence of a warning sign (e.g. "Pedestrian Crossing"). The 2009 MUTCD suggests they should be used only if pedestrians are crossing, and as such they should be activated by a pedestrian push button. Warning beacons may also be used at certain school crossings or in places with high pedestrian volumes. They can be combined with speed tables to increase safety. See Toolbox Section 8—Children and School Zones for more information.

Because yellow flashing lights allow drivers to continue without a full stop, care should be taken to position warning beacons only where sight distances are long enough to allow drivers to stop if a pedestrian is in the crosswalk. If traffic volumes or speed are high, or if the crossing distance is long, the Pedestrian Hybrid Beacon may be a better alternative at mid-block crossings.

ADVANCE WARNING SIGNS AND PEDESTRIAN CROSSING SIGNS (SIDE OR OVERHEAD)

Advance Pedestrian Crossing signs should always be installed in advance of mid-block crossings.

Placement of advance warning signs depends on the speed of motor vehicle travel and other conditions, such as available sight distance. Refer to the 2009 MUTCD for sign placement criteria. To avoid information overload and allow for improved driver response, advance pedestrian warning signs should not be mounted with other warning or regulatory signs (except for a supplemental distance sign or an advisory speed plate).

Other Design Considerations

Mid-block crossings should be well lit and may require pedestrian lighting to supplement existing street lighting.

Fences, barriers, signs, or sidewalk ramps can be used at mid-block crossings and refuge islands to channelize pedestrians to the crossing. Trees and landscaping can also be used to enhance and identify the crossing area, but care must be taken to ensure that these do not obstruct visibility at the crossing in any way.

Minimizing Pedestrian/ Motor Vehicle Conflicts at Intersections and Crossings

There are a variety of techniques to minimize conflicts between pedestrians and motor vehicles. These focus on maintaining sight distances, restricting turning movements, on-street parking restrictions, access management, and signalization.

Visibility and Sight Distance

Good sight distance at intersections and mid-block crossings improves pedestrian safety and should be designed into roadway geometry. Uncontrolled intersections and mid-block crossings are of particular concern where inadequate sight distance exists, because there is no control (stop sign or signal) over the movements of vehicles and pedestrians. Facilities such as signs, utility poles, bus stops, benches, and other elements are often added after design and construction of an intersection, inhibiting driver and pedestrian visibility. These elements should not be located in areas that interfere with sight distances, if possible.

Exhibits 5.37 and 5.38 illustrate the area at an intersection that should typically be kept clear

EXHIBIT 5.37 *Clear Travel Area*

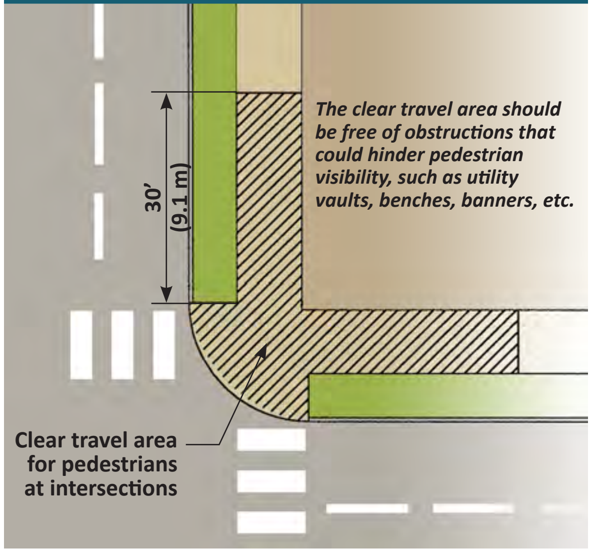
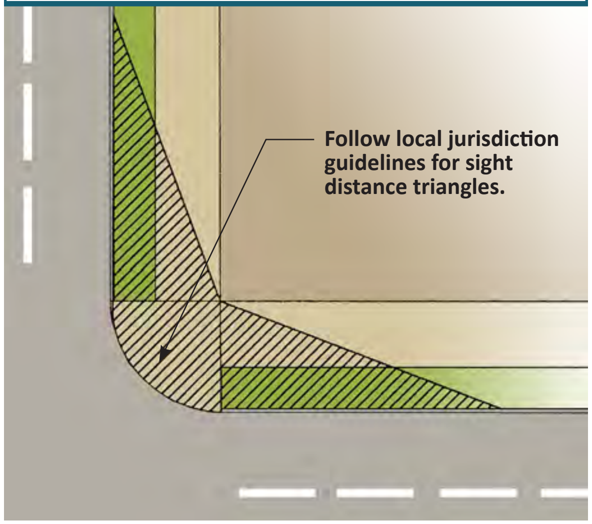


EXHIBIT 5.38 *Adequate sight distance must be maintained at all intersections.*



BUDGET ISSUES

Most municipalities must create pedestrian improvements within a stringent budget. Costs associated with different crossing treatments vary widely, as do their effectiveness. Municipal leaders must choose the treatment carefully. Sometimes a less expensive treatment may be the best choice and the most effective. Exhibit 5.39 lists costs of various crossing treatments and compares the relative effectiveness of each.

of obstructions. Refer to the HDOT standards or local guidelines for sight distance calculations at intersections and driveways.

Elements that obstruct the downward views of high-seat position drivers (such as bus and truck drivers) should also be avoided at intersections (within the sight distance triangle area; see Exhibit 5.38). This includes trees, signs, hanging banners, and other elements.

Curb extensions at crossing points provide space for pedestrians to stand in better view of approaching vehicles, and on-street parking can be placed closer to the crossing point without affecting visibility of pedestrians. (See Exhibit 5.29)

On-Street Parking Restrictions

On-street parking near pedestrian crossing points can interfere with visibility. When cars are parked too close to crossing points, they may block the line of sight between the driver and the pedestrian stepping off the curb to cross. Refer to Toolbox Section 2—Pedestrian-Friendly Streets for specific parking setback guidance.

***EXHIBIT 5.39** Crossing Treatment Cost Comparison: Both mid-block and intersection crossings can benefit from the wide variety of treatments. The cost of these treatments varies widely.*

CROSSING TREATMENT	COST	EFFECTIVENESS
		* Least Effective ***** Most Effective
SIGNING	$500 - $1,000 each+	*
ADVANCE STOP BARS	$1,000 - $2,000+	****
HIGH VISIBILITY MARKINGS	$2,000 - $15,000+	**
ILLUMINATION	$5,000 - $15,000+	****
MEDIAN ISLANDS	$10,000 - $30,000+	****
SIGNALS	$50,000 - $200,000+	***
OVER/UNDERCROSSINGS	$500,000 - $2,000,000+	*
PROPER LOCATION	"PRICELESS"	*****

Source: Adapted from Pedestrian and Bicycle Information Center. Costs are conceptual–to be verified on every project.

Traffic Regulations and Access Management

Traffic regulation and access management practices can help reduce potential conflicts between pedestrians and motor vehicles at intersections. For more information about access management, refer to Toolbox Section 2—Pedestrian-Friendly Streets.

Turning Movements

Regulating turning movements at intersections can improve conditions for pedestrians. According to the ITE, 37 percent of all pedestrian/motor vehicle collisions at signalized intersections involve turning vehicles. Exhibit 5.40 summarizes possible solutions to minimize pedestrian/motor vehicle conflicts involving turning movements. Many of these techniques are discussed in greater detail in this toolbox section.

DUAL TURNING MOVEMENTS

Dual turning movement lanes are particularly difficult for pedestrians when visibility is impaired by two lanes of vehicles turning at the same time. This increases the level of unpredictable vehicular movement, and motor vehicle speeds may be different in each lane. Drivers may even switch from one lane to the other while turning.

EXHIBIT 5.40 Reducing Turning Conflicts

Design compact intersections with small turning radii that force slower speeds
Prohibit right-turn-on-red
When right-turn slip-lanes are used, place crosswalks as far upstream as possible to provide high visibility for both pedestrians and drivers
Use a separate left-turn phase in conjunction with a pedestrian signal
Restrict left turns at busy intersections during hours of high pedestrian activity
Shorten crossing distance and exposure time with curb extensions or bulb-outs
Provide medians and refuge islands
Place signs to remind motorists of their duty to stop for pedestrians before turning
Consider providing an exclusive “pedestrian only” signal phase at intersections of high pedestrian use

Drivers may not be able to see beyond the car in front or to the side of them to determine if there is a pedestrian crossing the street. Dual turn lanes also create a wide crossing, which is already a difficult situation for pedestrians.

For all these reasons, it is strongly recommended that warrants for dual turn lanes be used to ensure that they are provided only if absolutely necessary. A separate pedestrian crossing phase or leading pedestrian interval signal timing should be used at these locations. (Refer to pages 5-9 through 5-12.)

Interchanges and Expressway Ramps

Expressways and freeways present barriers to pedestrian circulation. Pedestrians crossing exit and entrance ramps conflict with motorists whose attention is focused on other traffic and not on pedestrians. Exhibit 5.41 summarizes pedestrian-friendly design treatments at expressway ramps. Exhibit 5.42 illustrates recommended design practices for pedestrian crossings near on and off ramps.

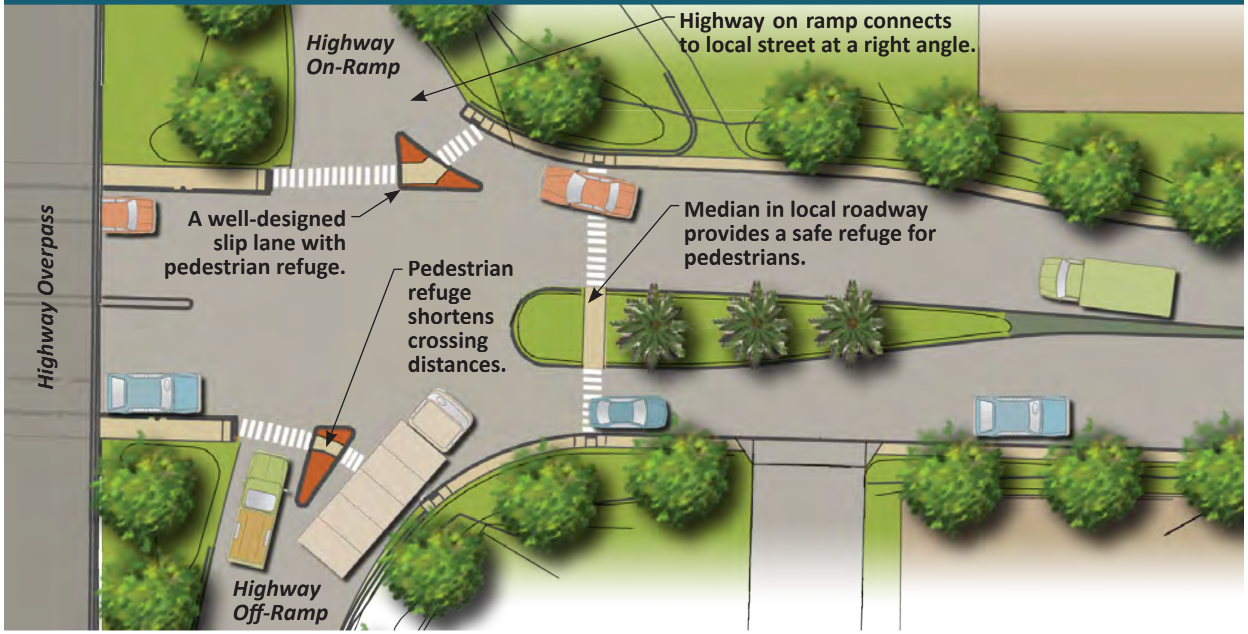
Grade Separation

Grade separation may be necessary at crossings where extreme conditions dictate the need

EXHIBIT 5.41 Design Treatments at Expressway Ramps

Provide as short a crossing distance as possible and at a right angle to the ramp.
Locate the crossing point at either the terminus or the beginning of the ramp, where the vehicle is just entering or has slowed from its exit.
Discourage free-flowing motor vehicle movements at on and off ramps where there is heavy pedestrian crossing traffic. Slowing or stopping of motor vehicles in these areas is strongly recommended.
Connect access ramps to local streets at right angles. This reduces crossing distances and increases visibility. Install controls such as stop signs and signals to provide pedestrians opportunities to cross.
Install raised pedestrian refuge islands at slip lanes where appropriate. See Exhibit 5.42.
Clearly mark pedestrian crossings at controlled access ramps so they are visible to motorists.
Provide good sight distance and visibility at ramp.
Provide grade separation only as a last resort.

EXHIBIT 5.42 At highway interchanges special design attention must be paid to pedestrian comfort and safety.



for pedestrians to be completely separated from the roadway (or from railroad tracks or waterways). Overpasses and tunnels can provide safe pedestrian crossing opportunities, however they can also be cost prohibitive, and potentially ineffective. Unless there is sufficient space for ramping it may be difficult to provide accessibility, and elevators may become necessary. If the added travel distances are excessive, pedestrians who want the most direct route may be discouraged from using the grade separated crossing. Grade separated crossings can be costly. Because of this and the barriers they can create to pedestrian travel, they should be used only as a last resort.

OVERPASSES AND BRIDGES

Overpasses and bridges should be easy and convenient for pedestrians to access. They may become feasible when topography or an adjacent building make ramping unnecessary on one or both sides. Pedestrian bridges can vary in their structure and may be pre-fabricated or constructed of cast-in-place concrete, pre-stressed concrete, steel, or wood. Consideration should be given to cost, constructability, maintenance, aesthetics, and physical site constraints. Overpasses and bridges should be designed by a professional bridge or structural engineer and follow the guidelines in the most recent AASHTO *LRFD Guide Specifications for the Design of Pedestrian Bridges.*

All pedestrian bridges must be assumed to provide service to both pedestrians and bicyclists. As a result, a railing to railing width of 12 ft (3.7 m) is preferable. Consideration also should be given to designing the bridge to accommodate emergency and/or maintenance vehicles. If a bridge is to accommodate emergency or maintenance vehicles, a 12 ft width (3.7 m) is mandatory.

Since pedestrian overpasses are lighter structures than vehicular bridges, and therefore less resistant to impacts, the vertical clearance of an overpass should be two feet greater than the clearance for vehicular structures over the same roadway (Hawaii Design Manual). Bridges built over waterways must maintain a minimum clearance above the 100-year flood level.

SKYWALKS AND SKYWAYS

Skywalks or skyways are elevated walkways between buildings. They allow pedestrians to pass between buildings without going to street level. Fully enclosed walkways protect pedestrians from being exposed to weather. Design of skywalks will largely be determined by the buildings into which they are built and thus are not discussed in detail in this toolbox.

UNDERPASSES AND TUNNELS

Tunnels and underpasses provide a walkway for pedestrians underneath the roadway. Pedestrians are often more apt to use overpasses than underpasses or tunnels, and overpasses are easier to supervise and maintain. Tunnels are less desirable than bridges due to greater potential costs, reduced sense of security, challenges with monitoring, the possibility of drainage problems, and a perception of lack of safety. Before choosing to install a tunnel, soil exploration is required to determine whether a tunnel can be feasibly constructed and whether drainage will be a problem. Wide openings are more inviting to pedestrians and let in more natural light. Tunnels should be easy to access and should be as short as possible. Approaches to the underpass should allow continuous vision through it.

Regent undercrossing on University of Colorado campus, Boulder, CO

Iron horse pedestrian crossing, Contra Costa County, CA

A NOTE OF CAUTION ABOUT SKYWALKS

Use of skywalks may lead to a loss of pedestrian activity at the street level, negatively impacting the retail businesses and economic vitality of the area. When skywalks are being considered, ways to ensure that street level retail will still be fully accessible and inviting to pedestrians should be implemented. In addition, any potential violation of the view corridor must be avoided.

Roundabouts

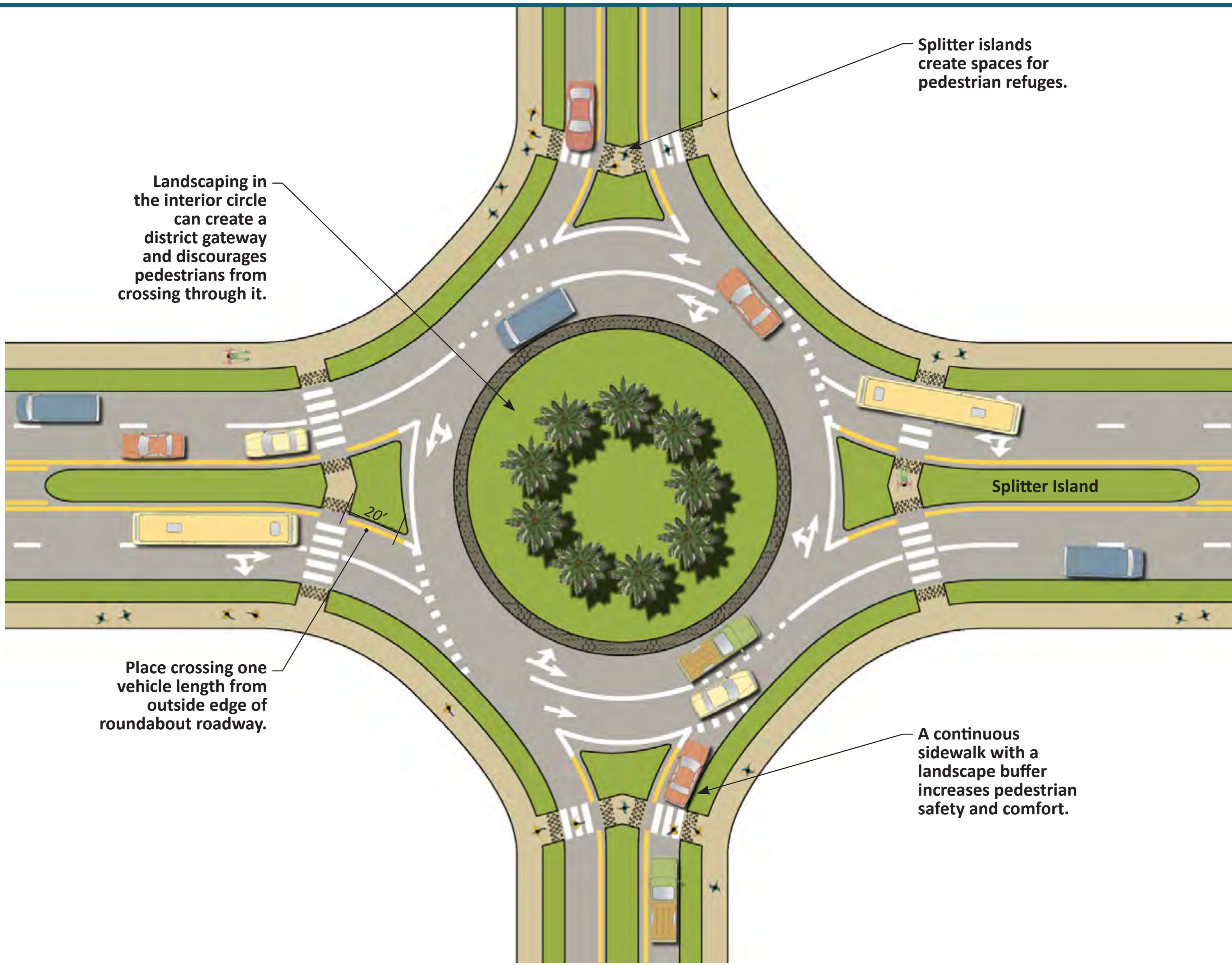
Modern roundabouts are designed to slow traffic, reduce delays, and handle higher traffic volumes. Research has shown fewer pedestrian collisions occur at roundabouts than at signalized or unsignalized intersections. Single lane roundabouts operate more safely than a two-way stop-controlled intersection, and they are less expensive to maintain than a signalized intersection. Single-lane roundabouts are safer for pedestrians than multi-lane roundabouts. Exhibit 5.43 illustrates a roundabout design with pedestrian crossing areas.

Pedestrians are not meant to cross into the center of the roundabout, and the interior of the roundabout can be designed to discourage this type of crossing. The following techniques can serve to discourage pedestrians from crossing into the interior:

- Application of rails along the roundabout legs to lead pedestrians and discourage them from crossing into the interior. As the radius, speed limits, and number of legs increase, rails are more necessary.

Roundabouts can act as district gateways.

EXHIBIT 5.43 A well designed roundabout can improve traffic flow and provide a safe and comfortable environment for pedestrians.



Flop over signs call attention to crossings.

- Landscaping that blocks the view across the roundabout (e.g. large shrubs and trees).
- Grade changes, such as small retaining walls, with shrubs, rocks, and other landscape elements on top of them.
- Absence of pedestrian amenities such benches.

Care should be taken to keep sight distances clear for motorists. These same elements can be combined to create an attractive and distinctive focal point for both motorists and pedestrians.

Roundabouts can feel unfriendly to pedestrians because of their size. However design solutions can be used to maximize pedestrian safety and comfort. These include:

- Sidewalks along the entire outer edge of the intersection.
- Crossings on all approaches. They should be located no less than 20 ft (6.1 m) from the outside edge of the roundabout roadway. This allows pedestrians to cross behind the first motor vehicle trying to enter the roundabout. “Stop here for Pedestrian” signs are not recommended. Splitter islands (which deflect the path of motor vehicles and slow them down at these crossings) provide places for pedestrian refuges.

Special attention should be paid to safety for sight-impaired pedestrians, because they rely on the sounds of traffic stopping and starting in different directions, which does not occur at roundabouts. See Toolbox Section 3—Accessibility.

Other Innovative Technologies

Soft Sandwich and Flop-Over Signs

Soft “sandwich board” signs can be an effective means of warning motorists to yield to pedestrians. Because they are typically placed in the center of the roadway they attract motorists’ attention. The soft design prevents injuries to pedestrians, bicyclists, and cars if they hit the sign.

Flashing and Warning Lights

Various types of flashing and warning lights have been used in association with pedestrian crossings. Embedded pavement or in-pavement flashing lights have been used by a number

EXHIBIT 5.44 *In-pavement warning lights make pedestrians more visible at night or in dark, cloudy conditions.*

of jurisdictions throughout the United States and are included in the 2009 MUTCD, Section 4N.02. They should be installed along the entire length of the crosswalk between its outside edge and ten feet from its outside edge. Refer to the MUTCD for recommended flashing rates, the number of lights to install and other design parameters. Compared with other types of warning devices, the effectiveness of embedded pavement flashing lights is high. Upon approach to a crosswalk with embedded pavement flashing lights, drivers are more apt to slow down and yield to pedestrians than when drivers approach a crosswalk with another type of lighted warning device. Also, compared to a crosswalk with no warning device, drivers are more likely to slow down and yield to pedestrians when embedded pavement flashing lights are in place. The device is particularly effective at night. A study conducted in San Jose, among other studies, confirmed the effectiveness of ***embedded flashing lights.*** See Exhibit 5.44.

The MUTCD has issued interim approvals to many jurisdictions across the United States for the optional use of rectangular rapid flashing beacons (RRFB). These devices are affixed to a pedestrian crossing sign and placed at mid-block crossings. Some of these devices use solar-powered, LED illumination, which is energy efficient. Interim approval allows interim use, pending official rulemaking, of a new traffic control device, a revision to the application or manner of use of an existing traffic control device, or a provision not specifically described in the MUTCD.

Puffin and Pelican Crossings

Puffin and Pelican crossings are in widespread use in Great Britain and in some locations in

A pedestrian activating a Puffin crossing in Cumbria, England

Flashing warning light (Rectangular Rapid Flash Beacon—RRFB)

the United States. Both use detectors to sense whether pedestrians are in the crossing, and they are both activated by pedestrian push buttons.

Puffin (Pedestrian User Friendly INtelligent Crossing) signals involve the use of special detectors that sense the presence of pedestrians in the crossing and prevent the light from changing until all pedestrians have cleared the roadway. It also allows the light to change when the crossing is clear of pedestrians. This may be a shorter time than a regular signal, allowing traffic to resume its normal flow. The pedestrian signal head is located on the near side of the crossing, at 45 degrees to the road edge facing oncoming traffic at about eye-level, so that pedestrians can see both the signal and oncoming traffic at once.

There is no signal head on the opposite side of the road. Puffin crossings can help at locations where there is high use by slow moving pedestrians (hospitals, schools, and retirement homes).

Pelican (PEdestrian LIght CONtrolled) signals insert a yellow flashing light into the sequence in the change over from red to green. This allows drivers to proceed if there are no pedestrians in the crossing.

Pedestrian-carried flags - PedFlag program in Kirkland, Washington

Pedestrian-carried Flags

Hand-carried pedestrian flags can be made available at each side of the pedestrian crossing. The pedestrian may be better able to attract the attention of the driver sooner by becoming more visible. This is a low cost device that can be installed for pedestrian use in a timely manner. Once the equipment is installed at the crossing the only ongoing cost is replacement of the flags. Because the pedestrian is aware of picking up and carrying the flag, they are more likely to be aware of crossing and traffic. Although there may be concerns that the flags can give pedestrians a false sense of security, there is no research to support this.

The use of pedestrian-carried flags has gained popularity around the country. Towns and cities in Alaska, Washington, Illinois, California, and other states have installed them. In Kirkland, Washington, the program is called ***PedFlag.***

Most of the evidence gathered shows that pedestrian flags are helpful in encouraging pedestrian safety. A report, available through the Transportation Research Board and National Cooperative Highway Research Program (NCHRP), *Improving Pedestrian Safety at Unsignalized Crossings,* describes the performance of various pedestrian safety treatments including pedestrian flags (see ***NCHRP 562*** page 19, Motorist Warning Signs and Pavement Markings). The use of pedestrian flags is not regulated by the MUTCD because they are not considered to be a traffic control device. (The MUTCD interprets flags to be similar to brightly colored clothing or reflective devices that may be worn by pedestrians.) Authorization for use is the responsibility of the controlling jurisdiction.

Special Pavement Markings

Zigzag and shark's teeth pavement markings are innovative treatments that can be used as traffic calming devices. In the County of Hawaii, zigzag lines have been painted at busy intersections and school zones to get motorists' attention and encourage them to slow down. Shark's teeth markings were also painted on blind curves, and have been observed to be effective at night due to the high reflectivity of the striping.

Effects of Pedestrian Improvements on Vehicle Capacity

As the recommendations in this toolbox suggest, current practices encourage design approaches that improve conditions for pedestrians and fully integrate them into the transportation system. Many of the techniques to improve pedestrian safety may affect vehicle capacity. Principal effects on capacity are caused by signalization, narrowing lanes, introducing curb extensions and bulb-outs, and reducing curb radii. Increased numbers of pedestrian crossings and bus stop relocations may also affect vehicle capacity. While these effects must be accounted for in all traffic engineering studies, they should not deter designers from introducing elements that will improve safety for pedestrians.

Other Resources

The following sources of information are recommended for design of intersections.

- American Association of State Highway and Transportation Officials (AASHTO). *A Policy*

Shark's teeth markings help keep motorists on the roadway at difficult curves.

Zigzag markings alert motorists to busy intersections and areas of high pedestrian activity, such as school zones and other areas.

on the Geometric Design of Highways and Streets, 5th Edition. 2004.

- American Association of State Highway and Transportation Officials (AASHTO). *A Guide for Achieving Flexibility in Highway Design.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for Development of Bicycle Facilities, 4th Edition.* 2012.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Planning, Design and Operation of Pedestrian Facilities.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *LRFD Guide Specifications for the Design of Pedestrian Bridges.*
- American Association of State Highway and Transportation Officials (AASHTO). *Roadside Design Guide.* 2002.
- American Planning Association, Wiley & Sons, Inc. publishers. *Planning and Urban Design Standards*. 2006.
- Ewing, R., *Pedestrian and Transit-Friendly Design: A Primer for Smart Growth.* R. Ewing for Smart Growth Network in Florida, 1999. ***http://www.epa.gov/smartgrowth/pdf/ptfd_primer.pdf*** (May 2013).
- Federal Highway Administration. *Guidelines and Recommendations to Accommodate Older Drivers and Pedestrians.* FHWA Publication No. FHWA-RD-01-051, May, 2001. ***http://www.fhwa.dot.gov/publications/research/safety/humanfac/01051/index.cfm*** (May 2013).
- Federal Highway Administration. *Informational Report on Lighting Design for Midblock Crossings.* 2008. ***www.fhwa.dot.gov/publications/research/safety/08053/index.cfm*** (May 2013).
- Federal Highway Administration. *Manual on Uniform Traffic Control Devices (MUTCD).* 2009.
- Federal Highway Administration, *Priorities and Guidelines for Providing Places for Pedestrians to Walk along Streets and Highways.* 2000.
- Federal Highway Administration. *Roundabouts: An Information Guide,* FHWA publication #FHWA-RD-00-068. ***http://www.fhwa.dot.gov/publications/research/safety/00068/*** (May 2013).
- Federal Highway Administration. *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations Final Report and Recommended Guidelines,* FHWA Publication No.: FHWA-HRT-04-100, September 2005. ***http://www.fhwa.dot.gov/publications/research/safety/04100/*** (May 2013).
- Institute of Transportation Engineers, *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach.* 2010.
- Institute of Transportation Engineers, Traffic Engineering Council Committee TENC-5A-5, Zegeer, Charles V. (Chair). *Design and Safety of Pedestrian Facilities, A Recommended Practice of the Institute of Transportation Engineers.* 1998.
- National Complete Streets Coalition. ***www.completestreets.org*** (May 2013).
- National Highway Traffic Safety Administration. National Center for Statistics and Analysis. *Traffic Safety Facts.* 2008 Data. Publication No. DOT HS 811 163.

http://www.walkinginfo.org/facts/docs/PedTSF_2008.pdf (May 2013).

- Oregon Department of Transportation and Oregon Department of Land Use and Conservation. Transportation Growth Management Program. *Main Street—When a Highway Runs Through It* (Main Street Handbook). 1999.
- Pedestrian and Bicycle Information Center. *www.walkinginfo.org* (May 2013).
- Pedestrian Safety Guide and Countermeasure Selection System, sponsored by the FHWA. *http://www.walkinginfo.org/pedsafe/index.cfm* (May 2013).
- Public Rights-of-Way Access Advisory Committee (PROWAAC) to the US Access Board. *Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations.* *http://www.access-board.gov/prowac/alterations/guide.htm* (May 2013).
- Seattle Right-of-Way Improvements Manual, City of Seattle, Washington—online access: *http://www.seattle.gov/transportation/rowmanual/manual/4_21.asp* (May 2013).
- US Access Board *Public Rights-of-Way Accessibility Guidelines (PROWAG).* Draft-rulemaking in process. *http://www.access-board.gov/prowac/* (May 2013).
- US Architectural and Transportation Barriers Compliance Board: *Accessible Rights-of-Way: A Design Guide.* 1999.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TheBus
thebus.org
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Town
Waikiki
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TOOLBOX SECTION

6

Pedestrian Access to Transit

Every transit trip begins and ends with pedestrian travel.

PEDESTRIAN ACCESS TO TRANSIT

This toolbox section discusses design practices that promote and enhance pedestrian access to transit and improve conditions at transit facilities, encouraging both transit use and greater levels of walking. Transit includes several types of systems and programs, including public bus services, bus rapid transit (BRT), rail and other fixed guideway systems, paratransit, shuttles, and vanpools. High capacity transit is a term used to describe systems that carry high loads of passengers (such as BRTs, light rail, commuter rail, street cars and other technologies). Transit systems may run within street, roadway, or highway rights-of-way or in independent alignments.

This toolbox section is not meant to be a comprehensive resource for designing transit facilities. Rather, it provides a summary of current best practices and design guidelines related to enhancing pedestrian access to transit. Examples from Hawaii and elsewhere are highlighted.

Refer to the list at the end of this section for other useful documents and resources.

Why Pedestrian Access to Transit is Important

Enhancing and expanding pedestrian access to transit and improving transit facilities are complementary to promoting pedestrian travel. Pedestrian and transit travel work well together. Every transit trip begins and ends with pedestrian travel. Good pedestrian facilities make the trip to transit stations and stops more convenient, safe, and enjoyable. If people do not feel safe or comfortable walking to transit stops, they are likely to choose other modes of travel, such as a car. Yet, transit use, as an alternative to driving, can bring many benefits:

- Decreased household transportation costs;
- Reduced environmental impacts (such as less air pollution and lower greenhouse gas emissions);
- Increased public health (people are likely to walk more to and from transit);
- Improved community livability;

IN THIS SECTION

- Decreased dependency on foreign oil resources; and
- Reduced overall infrastructure expenditures.

The success of transit as a mode of transportation is highly dependent upon good pedestrian access and the level of service and coverage provided. The provision of a variety of safe, efficient, reliable, frequent, and economical transit services and options give travelers and commuters more choices.

Accessibility

Because people with disabilities tend to rely on transit as their primary transportation mode, all transit facilities and the pedestrian routes that lead to them must be accessible. Federal laws require all new and renovated transit stations, stops, and transit facilities to comply with ADA Standards. As a best practice, facilities within the right-of-way, such as sidewalks and pedestrian pushbuttons, should comply with the proposed Public Rights-of-Way Guidelines (PROWAG). In Hawaii, the Disability and Communication Access Board (DCAB) provides design guidance and gets involved in review of the design of transit facilities. For example, Hawaii Revised Statutes 103-50 requires DCAB document review for all rail station plans and specifications to ensure compliance with ADAAG, as adopted and amended by DCAB.

For further information on accessibility, refer to Toolbox Section 3—Accessibility.

Transit in Hawaii

A variety of public transit services are currently provided in the islands, and some are in the planning stages. Transit operations are provided by each county on Oahu, Hawaii, Maui, and Kauai. Citizens and visitors on Molokai and Lanai are provided with transit service through a private, non-profit server, Maui Economic Opportunity, Inc (MEO). Various resorts also offer private transit services, and there are many private tour companies that use buses and shuttles to transport visitors in the islands.

SERVICES ON OAHU

- The City and County of Honolulu operates TheBus, which provides service throughout the island. A variety of route choices, timetables, and vehicle types (including hybrid buses) are

The success of transit as a mode of transportation is highly dependent upon good pedestrian access.

People with disabilities tend to rely on transit as their primary transportation mode, and all transit facilities and the pedestrian routes that lead to them must be accessible. (gohart. blogspot.com) provided. More than 230,000 people use the service on a typical weekday.

- The Handi-Van is a public transit service in the City and County of Honolulu for persons with disabilities who are unable to use TheBus. The Handi-Van service is generally available island wide, Mondays through Sundays from approximately 4:00 a.m. through 1:00 a.m. 24 hour service is available in areas located within ¾ mile of TheBus, Routes 2 and 40. Advanced reservations are required. Passengers are picked up and dropped off at the nearest and safest point next to the curbside of the public street address requested.

- The Waikiki Trolley (Green Line = Scenic Attractions, Red Line = Historic and Cultural Sites, and Pink Line = Shopping and Dining), provides service and tours focused in the Waikiki and Downtown areas.

- The Mililani Trolley provides service to over forty stops scattered throughout Mililani, mauka and makai sides.

- Private commuter services, such as the Leeward Oahu Transportation Management Association (LOTMA) Commuter Express and Kamehameha School Charter buses, are also available to serve commuters and students.

- College and university shuttle systems, including the University of Hawaii at Manoa and Hawaii Pacific University on-campus buses.

- Honolulu Rail Transit will be a 20-mile elevated rail line that will connect West Oahu with Downtown Honolulu and Ala Moana Center. The new transit service, which is currently in design, will carry more than 8,000 passengers per hour in each direction via electric, steel-wheel trains that hold more than 300 passengers each. New bus routes will provide direct connections to the stations. Honolulu Rail Transit stations are being designed to maximize pedestrian connectivity and mobility.

SERVICES ON THE BIG ISLAND

- The Hawaii County Mass Transit Agency provides low-priced public transportation on the island of Hawaii via the Hele-On bus (fixed route service). Fifteen routes connect the island, with monthly ridership estimated at over 67,000 according to a study completed in July 2009. In addition, the Transit Agency offers a Shared Ride Taxi program that

The Waikiki Trolley in Honolulu transports people to scenic, cultural, and retail attractions.

The City and County of Honolulu operates TheBus, which provides service to 230,000 islanders per day. (www.allhawaiinews.com)

The Hele-On bus provides low-priced public transportation on the island of Hawaii. (www.allhawaiinews.com)

On Kauai, the County operates the Kauai Bus from Hanalei to Kekaha daily. (Maui County)

provides low-cost door to door transportation within the urbanized area of Hilo.

SERVICES ON MAUI

- Maui County provides service on Maui via the Maui Public Bus Transit System. This public bus system provides service (fixed route) between various Central, South, West, and Upcountry communities. The routes typically operate seven days a week including all holidays, and is estimated to serve more than 6,700 passengers daily. Exhibit 6.1 shows the variety of transit vehicles operated on Maui.
- The Maui Bus Commuter Service operated by Roberts Hawaii is provided for early morning and evening commuter use to augment the Maui Bus Service (routes include Haiku-Wailea Commuter, Makawao-Kapalua Commuter, Wailuku-Kapalua Commuter, and Kihei-Kapalua Commuter).

SERVICES ON KAUAI

- The County operates the Kauai Bus, a public (fixed route) bus service and a Paratransit (door-to-door) bus service from Hanalei to Kekaha daily except on Thanksgiving, Christmas, and New Year's Day. In March 2011 the Kauai Bus ridership was 51,894 trips, and the Paratransit ridership was 6,129 trips. It provides service to the airport, but has limited service to Koloa/Poipu. In the past, there was a proposal to analyze the potential of implementing a high speed rail service on the island known as HART-BEAT, Hawaiian Air Rapid Transit—Beautiful Excursion Aerial Transport.

Transit Compatible Planning and Site Design

Planning for good pedestrian access to transit is an important way to improve community livability. New site and building design should always provide transit compatible features as a best practice.

Across the islands, as elsewhere in the United States, there are many sites and developments that were initially not designed to provide good access to transit. As more transit service is provided, these locations will need to be retrofitted to improve access to transit. Exhibit 6.2 shows an example of how a suburban office park was converted to mixed use and improved for better pedestrian access to transit.

EXHIBIT 6.1 ***Maui County Buses*** *(County of Maui)*

Some transit agencies may extend routes onto a private site to serve transit riders, but most won't operate off of public roadways because of the loss of travel efficiency. It is therefore important to provide good pedestrian access routes from buildings to the transit facilities on nearby public roadways (see additional guidance for pedestrian access routes later in this section).

Encourage transit use by providing direct lines of pedestrian access to transit. Make it easy and convenient for pedestrians to reach the transit stop. Consider the need for short cuts that reduce the distance a pedestrian must walk and provide more convenient access, in locations such as:

- Bridges over streams;
- Paths through parks and neighborhoods;
- Walkways that connect to/from dead-end streets; and
- Walkways in easements to enhance connectivity in neighborhoods with fewer streets or circuitous streets.

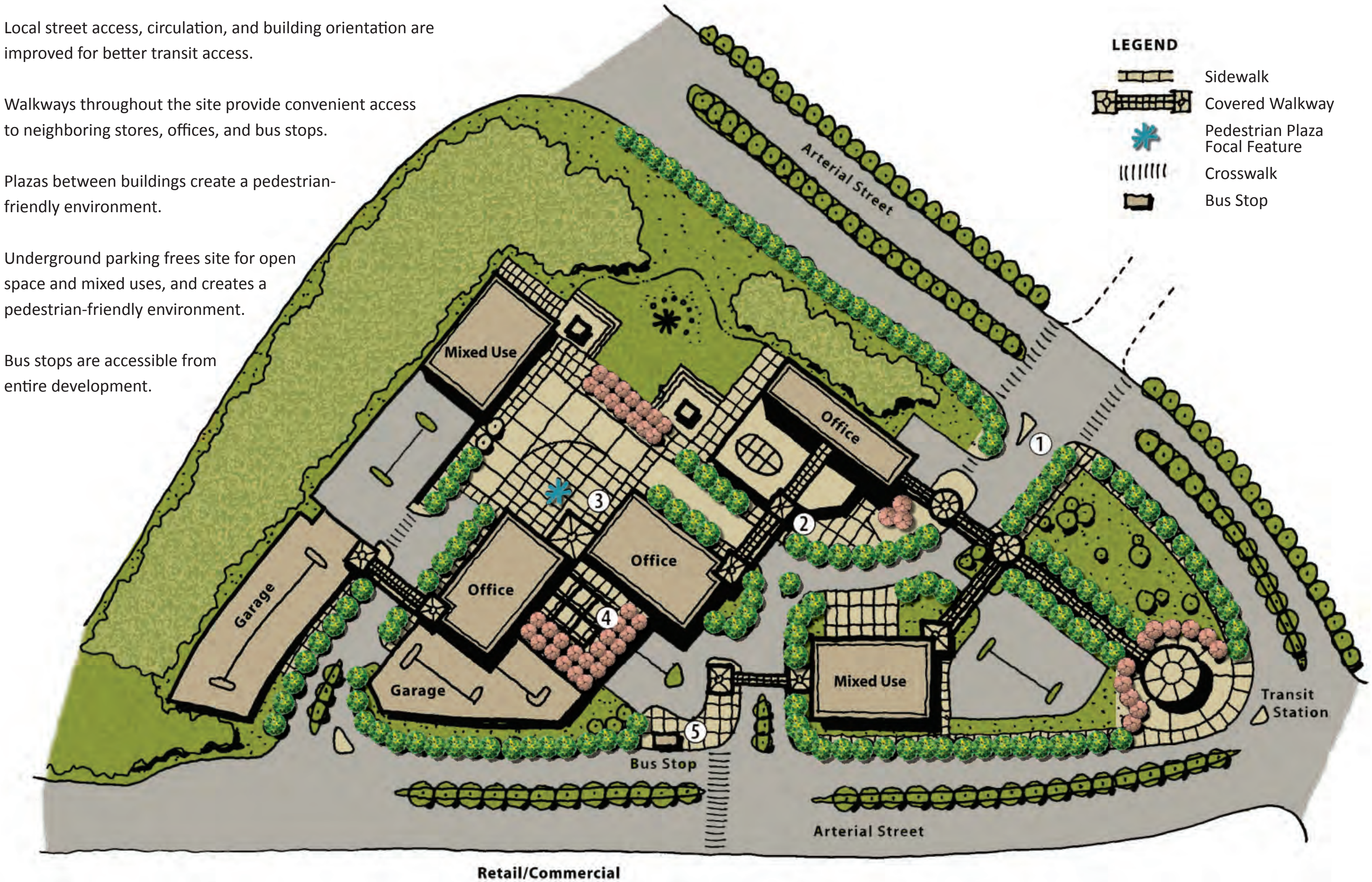
Transit-compatible site design objectives are highlighted in Exhibit 6.2.

Bus stop shelter with waste receptacle along a sidewalk in Honolulu.

Bus stop shelter along the Kamehameha Highway on Oahu.

EXHIBIT 6.2 *Transit Compatible Site Design Objectives*

1. Local street access, circulation, and building orientation are improved for better transit access.
2. Walkways throughout the site provide convenient access to neighboring stores, offices, and bus stops.
3. Plazas between buildings create a pedestrian-friendly environment.
4. Underground parking frees site for open space and mixed uses, and creates a pedestrian-friendly environment.
5. Bus stops are accessible from entire development.



Coordination Between Agencies

Coordination between transit agencies, local jurisdictions, and transportation system planners and designers is essential when planning and designing pedestrian facilities for access to transit. Land use planning efforts should consider ways to support transit use in communities. Communication and coordinated reviews between transit agency staff and local planners and engineers should occur during the beginning stages of projects.

As an example in the United States, the Central Phoenix/East Valley Light Rail Transit (LRT) project highlights some of the important features of TOD in Urban Design Elements. These include:

- Development of uses adjacent to LRT stations that create a viable “24 hour” area;
- Stations in the direct line-of-sight for pedestrians; and
- Public facilities and community services adjacent to stations such as libraries, police stations, and day care facilities.

Coordination between transit agencies, local jurisdictions, and transportation system planners and designers is essential when planning and designing pedestrian facilities for access to transit.

Transit-Oriented Development

The concept of Transit-Oriented Development (TOD) aims to create pedestrian-friendly communities that have good access to public transit. The mixes of uses that should be encouraged near a transit station to make it effective as a pedestrian and transit destination include mixed-use buildings with higher density residential development, commercial, retail, and office/employment uses, as well as public facilities such as plazas, community centers, and service centers.

Excess parking can discourage transit use. Consider incentives for new development or redevelopment adjacent to proposed transit stations and stops that reduce parking requirements. This is justifiable if public transportation is a convenient alternative to single occupancy vehicle travel. For example, the Lihu’e Town Core Urban Design Plan, through its special planning areas, allows the following:

“The Director may allow a reduction in the parking requirements for commercial uses and multi-family dwellings if a bus or transit stop with a pullout area is provided and built to county Transportation Agency standards (subject to County Transportation Agency approval). The parking requirements shall be one (1) space per 550 sq ft of net floor area or net office area for commercial uses and one (1) space per unit for multi-family dwellings.”

Refer to *Creating Transit Station Communities* and other resources listed at the end of this toolbox section for a more in-depth look at TOD. The *Creating Transit Station Communities* report discusses benefits, specific design principles, market analysis, and funding strategies for TOD.

Successful transit-oriented developments include pedestrian-friendly facilities and amenities such as shown in this Portland, OR example.

Transit Stop Locations

When feasible, transit stops should be located to minimize walking distances to and from the activity center that is expected to generate the most ridership. The more convenient it is to walk to transit, the more people will use the service.

A quarter-mile walking distance (typically five minutes) or less between activity centers and transit stops is generally considered to be optimal, with a half-mile (ten minutes) considered to be the maximum walkable distance. (Although some people will walk farther distances to reach transit, studies show that most people prefer to walk no more than half a mile.)

Activity centers are places that consistently generate transit ridership, such as mixed-use villages, multi-family housing areas, employment areas (office complexes, high rises, etc.), major shopping areas, entertainment districts, colleges, and other places.

In general, bus stops should be located to encourage safe crossing of streets at designated locations. The unique circumstances of stops near intersections should be studied on a case-by-case basis to determine the most appropriate location (as discussed in more detail on the following pages).

Spacing between Transit Stops

The following are recommended distances between transit stops.

- Urban Areas—Five to eight stops per mile, with maximum spacing of 750 feet between stops
- Suburban Areas—Four to six stops per mile with typical spacing of approximately 1,000 feet between stops
- Rural Areas—As needed, but typically not more than suburban areas

Note: If stops are placed too close together, the ride time becomes longer, which may make it more efficient to walk and reduce transit ridership.

Near-Side, Far-Side and Mid-Block Locations

There are generally three choices for locations of transit stops along streets: on the near-side of intersections, on the far-side of intersections, and at mid-block. Exhibit 6.4 lists considerations related to each of these placement options. In general, on streets with higher volumes and higher speeds, transit stops should be placed as close as possible to intersections, whether signalized or unsignalized (with a maximum recommended distance of 200 feet from the intersection).

Near-side stops are located on the approaching side of an intersection in relation to the direction of travel. Far-side stops are located on the departing side. Mid-block stops generally are not close enough to an intersection to be affected by the intersection operations.

In deciding whether to locate transit stops near-side, far-side, or at mid-block, placement should be reviewed on a case-by-case basis. Maximizing pedestrian access, convenience, and safety is important in selecting appropriate locations for transit stops. The unique circumstances of each potential location should include the following considerations:

- Walk time from intersection/crosswalk to stop

- Pedestrian sight distance
- Intersection capacity and configuration
- Turning lane conflicts
- Approach sight distance
- Cross traffic sight distance
- Traffic safety, including the potential for increased chance of rear-end collisions
- Congestion at the waiting area
- Traffic patterns
- Turning movements of the bus
- Curb clearance needs
- Location of crosswalks
- Location of nearby driveways

There are advantages and disadvantages related to locating bus stops near-side, far-side, and mid-block. Exhibits 6.3 and 6.4 compare each choice considering several of the circumstances listed above. Additional considerations are listed in the box on page 6-11.

EXHIBIT 6.3 Comparison of Near-Side, Far-Side, and Mid-Block Bus Stops

COMPARISON OF NEAR-SIDE, FAR-SIDE, AND MID-BLOCK BUS STOPS			
CONSIDERATIONS	NEAR-SIDE	FAR-SIDE	MID-BLOCK
Walk Time to Intersection	●	●	■
Pedestrian Sight Distance	■	■	●
Intersection Capacity / Configuration	■	■	●
Right Turn Conflicts	■	●	●
Approaching Sight Distance	■	●	●
Cross Traffic Sight Distance	■	■	●
Increased Chance of Rear-End Crashes	○	■	●
Congested Waiting Area	■	■	●
Right Turn Capacity	■	●	●
Traffic May Block Intersection	●	■	●

● Preferred ○ Acceptable ■ Not Preferred

Other Considerations in Locating Transit Stops

The following additional factors often influence decisions about where to locate transit stops.

- Availability of adequate right-of-way to ensure the stop meets PROWAG
- Curb clearance (i.e. clear access of the bus to the curb or adjacent property, not blocked by on-street parking)
- The intersection of two transit routes proceeding in the same direction should have the same stop as well as hubs and transfer points.

EXHIBIT 6.4 Bus Stop Placement Considerations

BUS STOP PLACEMENT CONSIDERATIONS		
NEAR-SIDE LOCATIONS	FAR-SIDE LOCATIONS	MID-BLOCK LOCATIONS
Allow pedestrians to cross in front of the bus, minimizing the distance those de-boarding have to walk to cross the intersection.	Allow buses to re-enter traffic more easily and in advance of the signal change allowing traffic behind the bus to proceed. Many transit agencies prefer far-side. The City and County of Honolulu Department of Transportation Services also prefers far-side.	Typically discouraged unless signalized mid-block pedestrian crossings are provided.
Bus operators have a direct view in three directions.	If transit stop is in-line, buses can immediately pull forward away from the curb. If the stop is a pull off, buses can pull out before the signal changes.	Where a mid-block crosswalk exists, transit stop should be located on the far-side of the crosswalk to maximize visibility to approaching traffic of crossing pedestrians.
If bus is stopped within the flow of traffic (in-line stop), it is easy for them to proceed when the intersecton signal changes.	No pedestrians are crossing in front of the bus.	Minimum interference of sight distance and intersection operations.
Parking restrictions near these zones can facilitate bus maneuvering.	Eliminates blocking of a signal by a bus.	May be less crowded sections of sidewalks at mid-block.
	Eliminates rear-end protruding into adjacent lane.	May be closer to center of transit patron generator.
	Transit routes turning left typically can access far-side or mid-block locations more readily.	
	Typically better for complex intersections, inlcuding those with dual left turning lanes and right turn lanes.	
	May cause delay and congestion by buses blocking right-turning traffic on a green signal (with in-line stops).	

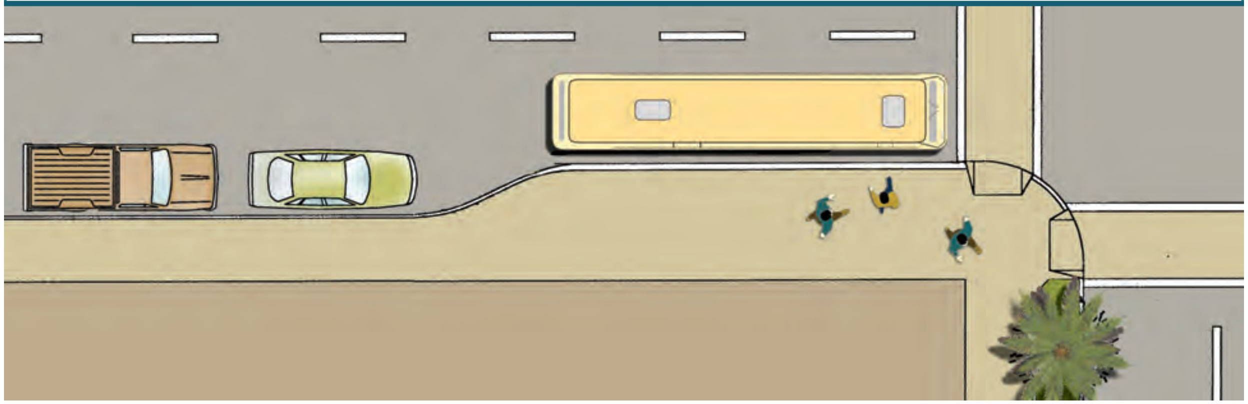
- It may be advantageous to locate stops nearby each other at the same intersection when two or more transit routes converge. This will make passenger transfers more efficient and convenient. Exhibit 6.5 shows bus stop locations oriented around a single street corner.
- In some areas, it may be desirable to locate transit stops off-street (such as to avoid the need for pedestrians to cross busy streets). Off-street stops are most appropriate at destinations that are set far back from the roadway (such as sometimes occurs with hospitals and shopping malls).

Highly efficient, comfortable, and convenient intermodal transfer connections between buses and between buses and high capacity transit are vital to the success of the entire integrated system.

A pedestrian area often can be designed as a combined facility with the stop, station, or platform and adjacent activity area. Transit representatives should work with local jurisdiction representatives to relocate bus stops, if necessary, to decrease walking time

EXHIBIT 6.5 *Same Corner Bus Stop Locations*

EXHIBIT 6.6 *Curb Bulb-out at Bus Stop Located on the Near-side of the Intersection*



for pedestrians. Designers should estimate/forecast pedestrian flows, patterns, and volumes between high capacity transit and bus stops to help determine walkway widths. Exhibit 6.6 illustrates a bus stop located along a curb extension area near an intersection.

Pedestrian Routes to Transit

If transit stations or stops on private or public sites (off street locations) are served by public transit, they are required to meet accessibility standards. On-site accessible routes of travel are required to meet ADA Standards, and pedestrian access routes within public rights-of-way must comply with PROWAG. Accessibility features such as curb ramps and pedestrian push button devices must be provided at intersections and crossings. Applicable ADA and PROWAG requirements are summarized below. Also refer to the information provided in Toolbox Section 3—Accessibility and 4—Sidewalks and Walkways.

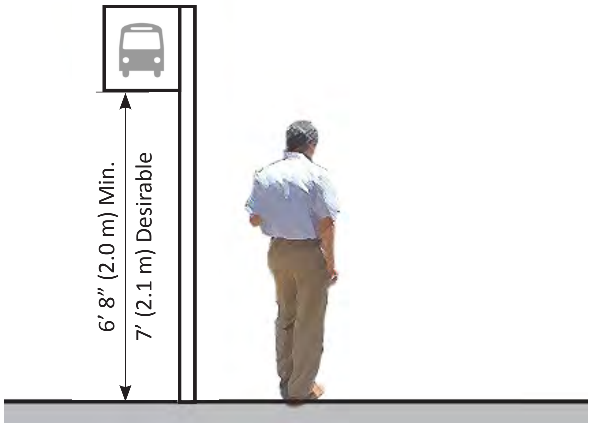
Horizontal and Vertical Clearances

The required minimum width per PROWAG is 4 feet of clear space, sufficient for a person in a wheelchair to use. The preferred best practice width is a minimum of six feet, enabling two adults to walk side-by-side and two wheelchairs to pass comfortably.

See Toolbox Section 4—Sidewalks and Walkways for recommended widths, but generally six-feet-wide is the recommended minimum, and wider sidewalks are desirable along arterial and collector streets and in urban areas. Along more congested pedestrian routes, where groups of people are commonly walking (such as in town/village centers, in urban areas, and around key destinations), pedestrian travel ways should be wider, with a minimum width of ten feet.

Adequate horizontal and vertical clearances around street furnishings, parking meters, sign posts, and other elements located in the pedestrian realm must be provided. Vertical clearance between the sidewalk grade and overhanging signs, signs along the street, tree branches, and other obstructions must be provided. A vertical clearance of 6 ft-8 in (2.0 m) is the minimum required by ADA from the pedestrian surface to the bottom of the obstruction, but a 7 ft (2.1 m) vertical clearance is the recommended best practice. Exhibit 6.7 illustrates sign clearance.

EXHIBIT 6.7 *Bus Stop Sign Vertical Clearance*



This streetcar shelter in Portland, Oregon separates the pedestrian walkway from the waiting area. (www.protransit.com)

A bus stop in Honolulu with a wide pedestrian walkway allows space for loading and unloading.

Passing Spaces

Pedestrian access routes that are less than five feet wide shall provide passing spaces at intervals of 200 ft (60.9 m) maximum in accordance with ADA. The best practice is to provide sidewalks at a continuous width that does not require passing spaces (see recommended widths in Toolbox Section 4).

Cross Slope and Gradients

The cross slope of a pedestrian access route shall not exceed two percent maximum in accordance with PROWAG.

Pedestrian access routes located in public rights-of-way of streets and roadways should follow the PROWAG standards of maximum five percent grade to the extent feasible. However, if the longitudinal slope of the roadway is steeper, the grade of pedestrian route is allowed to follow (but not exceed) the general grade of the street or roadway.

Accessible routes of travel (off-street) on developed sites shall not exceed the maximum gradient of five percent in accordance with ADA Standards. Ramps may be designed within the route in accordance with ADA standards, not exceeding a 12:1 or 8.33 percent gradient. (See Toolbox Section 3 for ramp design guidance.)

Surfaces

ADA Standards and PROWAG require a firm, stable, slip resistant surface along accessible routes of travel and pedestrian access routes. Paved surfaces are generally preferred because they are easier to maintain in this condition. However, other surfaces that meet the “firm, stable, slip resistant” criteria may be acceptable, depending upon installation and maintenance.

Provide surfaces that facilitate good traction without changes in level. Pavement texture and color can also be used to communicate function and spatial relationships for the visually impaired. Pavement texture should not induce excessive vibration for pedestrians using wheelchairs (such as that created by wide, mortared joints of unit pavers).

Lighting

In addition to night-time use of transit, riders often commute to work or school in early morning and late afternoon and evening hours. Pedestrian access routes and accessible pedestrian routes to transit should be well-lit.

Pedestrian scale lighting should be provided along the route, as well as surrounding and within the transit stop area. Lighting should be scaled appropriately to tree canopies and the pedestrian level of activity (with intensity focused on the walking surface). Minimize areas of shadow and low light to decrease the potential for obscured visibility and a compromised sense of security.

Visibility

Open, visible sightlines are important along access routes to transit for safety and security. Both pedestrians and motorists should have open, clear sightlines.

Wayfinding

Wayfinding elements and directional and identification signs help direct pedestrians to stations from transit stations/centers, bus stops, park and ride lots, adjacent pedestrian areas, major neighborhood intersections, and key cultural, educational, and recreational facilities. Regulatory and safety signs encourage safe pedestrian activity in and around transit stations. Providing wayfinding and directional signs to help pedestrians find their way is particularly important along routes where the bus stop is not clearly visible.

Pedestrian Comfort and Amenities

Weather protection and pedestrian furnishings such as benches and leaning rails should be provided periodically along the access route (particularly if it covers a long distance). Other amenities (waste and ash receptacles, information kiosks, etc.) can enhance the character of the pedestrian environment and encourage pedestrian activity.

All furnishings and elements in the pedestrian environment should be durable, lasting, vandal resistant, comfortable, and attractive.

Trees, Landscaping, and Public Art

Trees, landscaping, public art, and other features can help make the walk route more attractive and inviting. (See additional landscaping recommendations later in this section.)

Maintenance

Provide ongoing maintenance of access ways to transit, transit facilities, and surrounding areas. Preserve these areas in an attractive, inviting, safe, and secure condition to encourage ongoing transit access and use. Consider aesthetics and maintenance requirements in the initial design phase, rather than as an afterthought.

Pedestrian access routes to transit should be well-lit.

Providing space for shelters and waiting areas is essential. (www.commons.wikimedia.org)

A raised pedestrian crosswalk is provided at the Waipahu Transit Center on Oahu. (www.google.com)

Intersections and Crossings Near Transit

- Curb cuts with slopes no steeper than 1 inch of level change across 12 inches of distance are needed where level changes occur (such as a crosswalk).
- Coordinate pedestrian signals and other traffic control devices with timings that allow pedestrians sufficient time to comfortably cross the street to reach the transit station or bus stop.
- Provide good visibility and clear lines of sight at pedestrian crossings near at-grade stops (including bus transit, light rail, and commuter lines).
- Minimizing conflicts with vehicular traffic along the accessible route can make pedestrian travel more efficient to and from the transit stop/station.

Designing and Improving Transit Facilities for Good Pedestrian Access

The following guidance applies specifically to designing various types of transit facilities with the intent to maximize efficient, convenient, and safe pedestrian access to transit. Transit facilities include transit stations and transit centers (bus and rail), bus stops, and other places where pedestrians access transit services. These types of facilities may include buildings (enclosed and open air), transit platforms, bus stops (with or without shelters and furnishings), and park-and-ride areas. General guidance is provided first, followed by specific guidance related to these various types of facilities.

Refer to additional guidance in other toolbox sections as well as the local requirements of transit and transportation agencies. For example the City and County of Honolulu Department of Transportation Services and Maui County both publish design guidelines for their transit facilities.

General Guidance

The guidance described above under Pedestrian Routes to Transit (horizontal and vertical clearances, passing areas, cross slope and gradients, surfaces, lighting, visibility, wayfinding, comfort, landscaping and amenities, and maintenance) is also applicable to pedestrian areas surrounding and within transit facilities. In addition, the following guidance applies to all transit facilities.

PASSENGER WAITING, LOADING, AND LANDING AREAS

Design all passenger waiting areas to be open, secure, inviting, well-lit, and comfortable for pedestrians. The following guidance also applies.

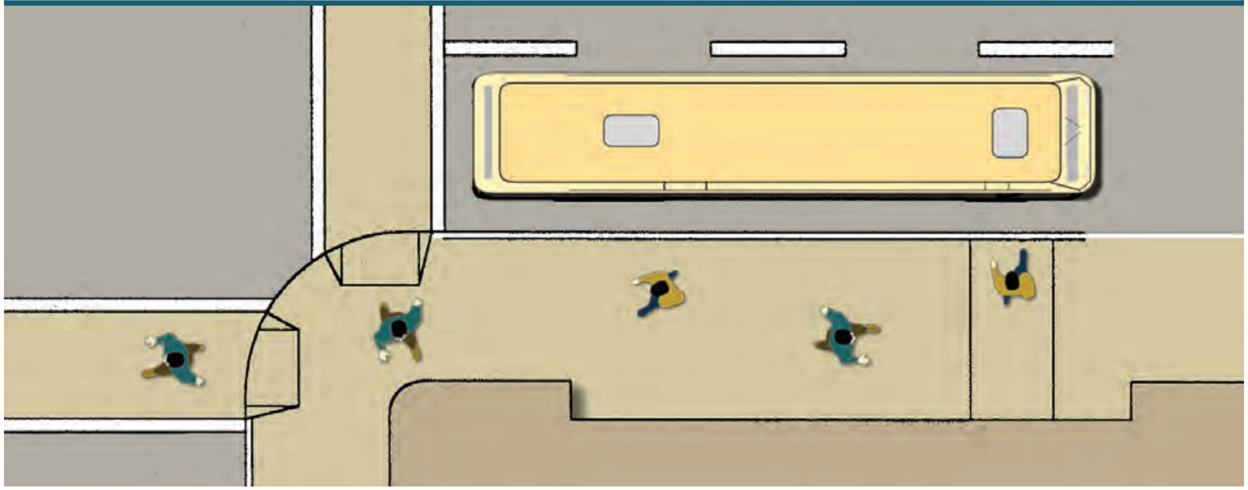
- Provide shelters and covered structures where feasible to protect passenger waiting areas from wind, sun, and precipitation. Waiting space for people in wheelchairs under the sheltered stop must be provided, adjacent to other seating areas. (See Exhibit 6.10)
- Maintain open sight lines between the bus operator's view and the passenger loading areas with shelters and windows constructed with transparent materials to provide a view of waiting passengers.
- Provide a minimum vertical height clearance in the bus stop zone of seven feet from ground level to the bottom of the signs and overhanging tree branches.
- Provide posted schedule information, or if possible, electronic real-time signs so patrons can anticipate bus, trolley, or train arrival. Route and spider maps (that show more than one bus route) are also helpful.
- Improve pedestrian mobility and transit efficiency by providing separate spaces for pedestrians who are waiting/queuing to board or deboarding, as well as those who are transferring between buses and those who are passing through, if possible.
- Provide clear delineation of pedestrian spaces with visual and textural cues that separate pedestrian spaces from parking and driving aisles and bus ways. Refer to PROWAG Standards for guidance on placement and design of detectable warning strips.
- Provide level landing areas or "pads" (also called pedestrian access aisles) at bus entrances and exits as required by ADA. The purpose of the landing pad is to accommodate lifts and ramps to service wheelchair boarding. The landing pad is an unobstructed, level area contiguous to the curb that measures a minimum of 5 ft (1.5 m) parallel to the street/

Design all passenger waiting ares to be open, secure, inviting, well-lit, and comfortable for pedestrians.

bus zone and 8 ft (2.4 m) perpendicular to the street/bus zone. (Refer to Exhibit 6.8.) Landing areas must be free of street level obstacles such as signs, light posts, pay phones, shelters, kiosks, trash receptacles, trees and landscaping or other elements. Exhibit 6.9 illustrates recommended cross section dimensions at a bus stop.

- To provide for rear-door alighting from larger buses, either provide an additional landing pad or a full-width landing area (ideally at least 30 ft (9.1 m) in length for stops served by 40-foot-long buses or at least 40 ft (12.1 m) in length for stops served by 60-foot-long articulated buses.
- Stops where more than one bus is boarding and alighting passengers at the same time will need additional landing pad areas to be determined by the size and placement of the buses serving each stop.
- It may be desirable to build a continuously wider sidewalk along the entire length of the bus stop, rather than try to predict where the landing should be located. Buses may not stop in the exact location each time.

EXHIBIT 6.8 Widened Sidewalk in Bus Loading Area



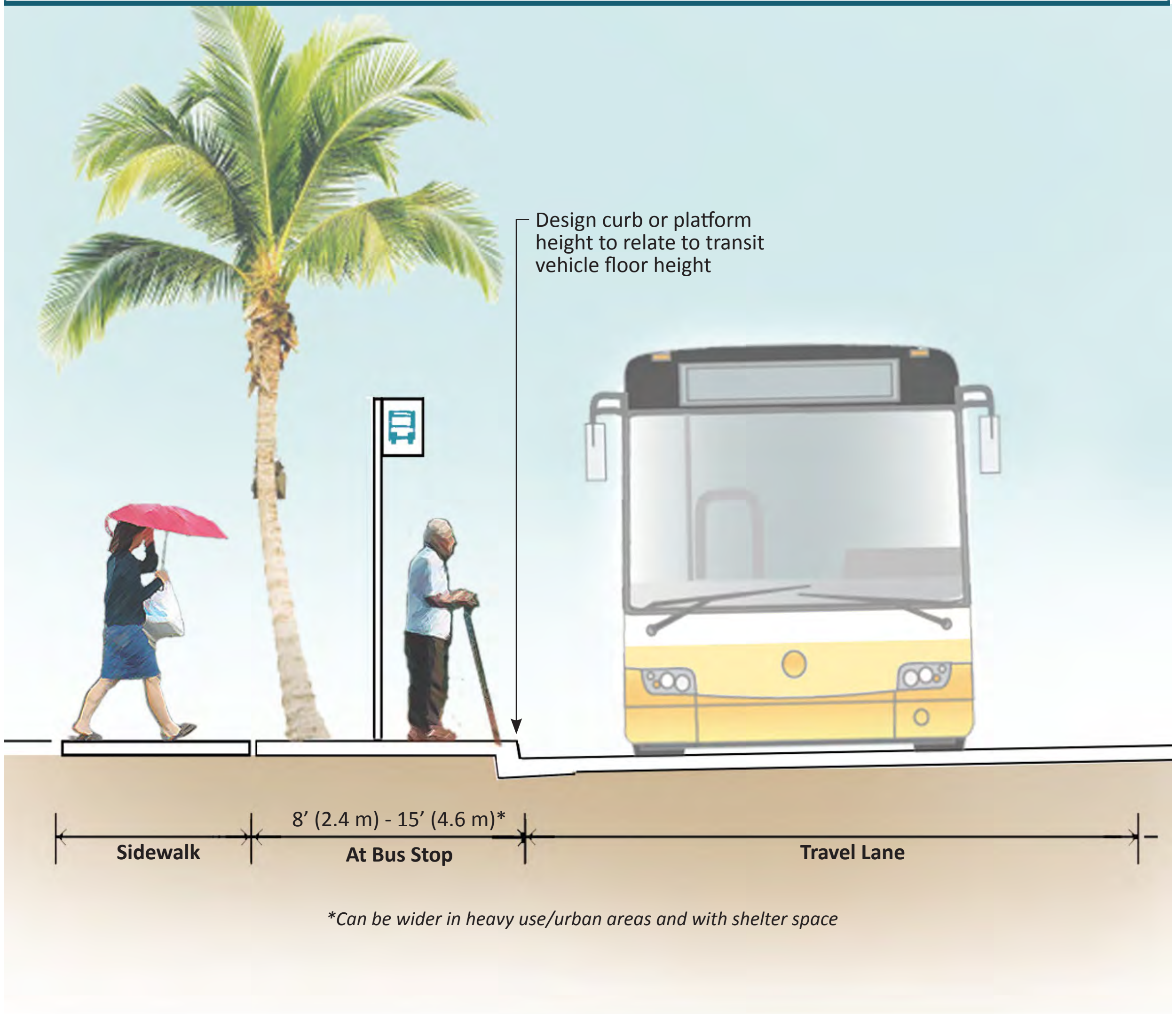
- Areas such as “kiss-and-ride” motor vehicle, taxi, or van drop-off locations must also include an ADA compliant pedestrian access aisle (sidewalk) area for safe pedestrian loading and unloading.
- Provide furnishings and amenities (addressed previously in this section), designed, selected and installed in accordance with ADA Standards and PROWAG. Installation should not block the accessible landing area/pad or primary pedestrian and wheelchair passage areas around and within the transit station or stop.

PARKING/PARK-AND-RIDE AREAS AND CONNECTING ACCESSIBLE ROUTES

Parking areas at park-and-ride facilities facilitate transfer from motor vehicle to transit. As people are transferring from one mode to the other, they are pedestrians with specific needs to be addressed. Pedestrian access ways in parking areas should be clearly delineated. Lighting for security and pay phones should be provided to assist pedestrians who may have car trouble. The following guidance also applies.

- Provide easy access to and from surrounding neighborhoods and businesses. Remember,

EXHIBIT 6.9 *Typical Bus Stop Cross Section*



Transit shelter with photovoltaic system on roof

Kiss-and-ride sign at the Hawaii Kai Transit Center

If a transit facility is contained within a building, at least 60 percent of public entrances need to be accessible. (www.allhawaiinew.com)

EXHIBIT 6.10 ***Bus shelters and covered structures enhance pedestrian comfort.***

not all park-and-ride patrons are motorists. Pedestrians may walk to the park-and-ride from nearby areas to access transit.

- Design the site with landscaping, public art, and other aesthetically pleasing features that will attract use and enhance the community/neighborhood.
- Mixed use development, when integrated with the park-and-ride, provides services and retail that enhance the pedestrian experience.
- Provide accessible parking spaces in accordance with ADA Standards and HAR 11-219 with aisles alongside (and wider access aisles at van accessible spaces).

- Locate accessible parking spaces closest to the transit boarding/deboarding area.
- Provide at least one accessible route, safely delineated over the entire site, connecting the accessible parking spaces and passenger loading zones, bus stops, and public sidewalks on adjacent streets. Multiple routes may be necessary if it is a large park-and-ride to provide access from locations throughout the site to the boarding area. The route must connect all accessible elements (including any public phones, sheltered areas, drinking fountains, ticket vending, or other elements that transit patrons use.)
- A maximum walking distance of 800 ft (243.8 m) from the car to the bus loading zone is recommended.
- Provide curb ramps and curb cuts where necessary along the accessible route.
- Avoid changes in level along the route, but if an unavoidable change in level occurs, a ramp, lift, or elevator must be provided. Ramps must have handrails and level areas at the top and bottom of the ramp.
- Turnstiles shall not be part of an accessible route. Accessible route shall be located adjacent to the turnstile.
- To encourage transit use in urban areas parking around stations and stops may need to be limited. Refer to transit oriented development earlier in this section.

BUILDINGS, RESTROOMS, ELEVATORS, AND DRINKING FOUNTAINS

If the transit facility includes public buildings or is contained within a building, at least 60 percent of public entrances must be accessible. Additional accessible entrances may be required if the transit station has multiple access points (such as for inbound and outbound travel), more than one emergency exit, or an enclosed parking garage with direct pedestrian access. Features such as restrooms, elevators, and drinking fountains, if provided, must be accessible. The following guidance also applies.

- Restrooms/Toilet Rooms—If the station/facility has a restroom, it must be accessible with the following key features:
  - Door with adequate width, lever handles, and little to no threshold, as well as maneuvering space on both sides that allow accessible approach entering and exiting (see ADA Standards for dimensional requirements)
  - Space that allows a half or full wheelchair turn within the toilet room
  - Toilet with clear and level wheelchair space to allow for transfer, accessible toilet seat height, grab bars on the back and side of the wall, and accessible flush controls on the open side
  - Urinal with elongated rim located at an accessible height, clear and level wheelchair space that allows front approach and accessible flush controls
  - Lavatory with clear and level wheelchair space that allows front approach, knee and toe space under the fixture, insulated pipes under the fixture, and accessible faucet
  - Toilet accessories, such as toilet paper dispensers and soap dispensers, within an

Mililani transit center *(www.starbulletin.com)* accessible reach range and operable with one hand, not requiring tight grasping, pinching or twisting of the wrist

- Elevators—provide at least one elevator to serve multi-story buildings and stations. All elevators must be accessible. Key features of an accessible elevator include:
  - Automatic operation by passenger
  - Call buttons within accessible reach
  - Hall lanterns and in-cab position indicators mounted high with a visual and audible notification
  - Signs on both sides of the elevator door with raised numbers/letters and Braille for each floor
  - Door reopening devices that detect obstructions without contact
  - Adequate size to accommodate people who use wheelchairs
  - Interior elevator controls within accessible reach range, raised buttons, and raised number or letter and Braille
  - Emergency two-way communication within the elevator that is accessible to people who are deaf or hearing-impaired/hard of hearing.
- Drinking Fountains—if provided, at least half of the drinking fountains must be accessible to people in wheelchairs (or if only one – it must be accessible). Key features of an accessible drinking fountain include:
  - Spout that directs water flow parallel or nearly parallel to the face of the unit
  - Controls located on the front or side of the drinking fountain that are operable with one hand and do not require tight grasping, pinching, or twisting of the wrist
  - Clear floor space that allows use by a person in a wheelchair when facing the drinking fountain from the front
  - Knee and toe clearance at drinking fountains that allow approach from the front

SIGNING, COMMUNICATIONS, AND FARE VENDING

Signing, communications (such as public phones and public announcement systems) and fare vending must be accessible in accordance with ADA Standards requirements. The following guidance applies.

- Transit stops and stations should include route identification signs with a non-glare finish and light text on a dark background (or dark text on a light background). Signage with the international symbol for accessibility should be used to identify ramps and other accessible features.
- Station identification signs must be provided at frequent intervals, clearly visible from within either side of the transit vehicle (bus, trolley, train, etc.) and designed with appropriate character height based on viewing distance.
- Wayfinding and directional signs along walkways help pedestrians find their way to and from the transit facility. The walkable distance (expressed in minutes) to nearby transit facilities, such as bus stops, could be included. (This would be especially helpful to tourists in Waikiki.)

Wayfinding sign in New York City (Christopher Edwards)

This bus stop sign in Seattle, WA provides a route map of the downtown area. (Oran Viriyincy)

- Each entrance of a transit station/building must have a sign with raised and Braille characters, mounted at an accessible height location.
- Signs that designate permanent public rooms and spaces, such as restrooms/toilet rooms, must have raised and Braille characters, non-glare finish, light text on dark background (or dark text on light background), and must be mounted at an accessible height and location.
- Signs that provide information about or direction to a room or space (such as "Employees Only") must also have a non-glare finish and light text on a dark background (or dark text on a light background). The City and County of Honolulu guidelines call for minimum height font of 3 in. Refer to the City and County of Honolulu guidelines for additional guidance. ***(www.honolulutransit.org)***
- Illumination levels in areas with signage must be uniform and located to minimize glare.
- If public phones (such as pay, security or closed circuit) are provided, then accessible telephones must be provided for people in wheelchairs, people who are deaf or hearing-impaired, or people who have difficulty with speech/language. Key features of an accessible telephone include:
  - Clear space that allows a wheelchair to approach from the side or front
  - Operable parts, such as the coin slot, within accessible reach range
  - Volume control with a sign depicting a telephone with radiating sound waves
  - Text telephone (TTY)
- Where a public address (PA) system provides audible information to the public at the transit station, then a means of providing the same or equivalent information to persons who are deaf, hearing-impaired, or with hearing loss must be provided.
- If automated fare vending systems are provided, at least one of each type of device must be accessible and provided at each point of entry or exit. Key features of an accessible vending device include:
  - Clear space that allows approach by wheelchair users from the front or side

— Device controls that are within accessible reach range and operable with one hand, not requiring tight grasping, pinching, or twisting of the wrist

— Accessible and discernable to people who are sight-impaired

DETECTABLE WARNING STRIPS

Detectable warning strips are raised domes on the floor surface typically in a highly visible or contrasting color such as yellow. Their purpose is to alert all pedestrians (including those with sight-impairments) about locations where the pedestrian way is adjacent to (and approaching a crossing of) motor vehicle, train, or bus traffic. Refer to ADA Standards and PROWAG for specific requirements.

ADJACENT ACTIVITY AREAS

Adjacent activity areas are defined pedestrian areas between multiple transit stops or between passenger drop off areas at curbside and transit stops. These areas should be designed similarly to urban plazas or as "park-like" spaces that provide seating areas and other furnishings, decorative plants, public art, drinking fountains, information kiosks, rail or bus arrival and departure information and "sociability" opportunities such as shaded seating areas. The design of these areas enhances the pedestrian environment and encourages use of the transit system.

Activity areas should also accommodate linkages to existing community amenities, provide sufficient bicycle parking and storage facilities, and provide space for outdoor food vendors.

LANDSCAPING AT TRANSIT FACILITIES

Landscaping around transit stations, stops, and waiting areas provides a visually pleasing environment and shade relief from the heat. Distinctive plants should be used to identify the stations as landmarks. Plants that represent the local and natural environment should also be encouraged. Trees that will provide maximum shade should be planted around the station. Avoid trees and plants that drop fruit or have features that could injure pedestrians (such as thorns, spines, or spikes).

Landscaping and irrigation should be designed to maximize water conservation and minimize maintenance requirements. Transit authorities

Detectable warning strip at a Seattle, WA streetcar stop (www.seattletransitblog.com)

The Hawaii Kai Transit Center is nicely landscaped and maintained.

should seek partnerships with surrounding businesses and/or neighborhoods to create small gardens or parks to enhance the pedestrian environment around stations.

Specific Transit Facility Guidance

In addition to the guidance above that applies to all transit facilities, the guidance below is specific to various types of transit facilities.

TRANSIT STATIONS AND TRANSIT CENTERS

Transit centers typically provide an area for transit lines or bus routes to come together at one location for transferring riders. They can also serve as important points of origin and destination.

Transit centers should be sited to optimize pedestrian access to major activity centers, such as downtowns, town centers, and major origins and destinations such as airports, shopping centers, university campuses and other locations. Transit centers promote transfer connections between different transportation systems, because they are highly visible facilities within the community. This high visibility and profile in the community also helps increase public awareness of the availability of transit service.

Both off-street and on-street transit centers can be developed, depending on the space requirements, street traffic volumes, passengers within walking distance, and other factors.

Transit centers function best when designed to meet the demands of peak user levels. Platform space needs to be adequate to accommodate all pedestrians, including those who are waiting, queuing, or simply walking up and down the

Both on-street and off-street boarding areas are provided at this example–the Lake Stevens Transit Center, WA.

sidewalk or platform. A common rule of thumb for determining space requirements for platform areas is ten square feet per person, using the peak pedestrian volume anticipated.

The most important element of design for transit centers is minimizing circulation conflicts between buses, pedestrians, bicyclists, light rail vehicles, and autos. Pavement delineation with texture, color, or striping helps to identify spaces that are for exclusive use by pedestrians. This also helps in boarding areas. Buffering techniques with planter boxes, street trees, furnishings, or other circulation design elements can be used to provide separation between pedestrians and automobiles.

High capacity rail transit pedestrian platform areas at stations are approximately 14 ft (4.26 m) to 16 ft (4.87 m) wide (or wider) by 300 ft (91.4 m) long (or longer) for use by passengers boarding or exiting trains. Platforms for bus rapid transit (BRT) may be shorter and narrower than this depending on the vehicles in operation. Sometimes platforms are split on either side of the system trackways (roads for BRT) and boarding/deboarding activities are also split. Or sometimes a single larger platform is centered between the trackways/roads and pedestrians use this area for both boarding and deboarding.

When high capacity transit is located in street rights-of-way, pedestrian platforms/stations may be located either at the sides of the streets (along pedestrian sidewalk areas) or in the center of the street, where passengers can access the stations from a signalized intersection.

The station platform is usually identified by signing or other features so that it can be readily seen by pedestrians. Shelters for shade, sound, and rain protection are usually provided on the platforms. The platform area also typically provides seating and sometimes leaning areas, route maps, timetables or "real time" information, and trash receptacles. Ticket vending machines are often located near the entry area to the platform. Other amenities such as drinking fountains, public telephones, and public art also may be provided. They should also be well lit to enhance passenger security.

All stations and their site features should be designed for accessibility in compliance with the

Platform surface graphics help users identify bike and wheelchair boarding areas; Edmonds, WA.

ADA. Since platforms are generally raised with curb heights from 10 to 15 in (25.4 to 38.1 cm) (height varies depending on the vehicle used), an accessible ramp must be provided from the level of the crosswalk or sidewalk to the raised platform height. Generally, it is preferable to provide these ramps at less than 5 percent grade, but if steeper slopes are required, the design is to be treated as a ramp with landings and handrails meeting ADA Standards and PROWAG. Refer to Exhibit 6.15.

BUS STOPS

The level of improvements at bus stops tends to vary. In urban and suburban areas, it is common for a shelter, bench, and trash receptacle to be provided, along with the bus sign and passenger waiting/loading area. Some stops may even include landscaping and public art features. In rural areas, bus stops may be as simple as a sign, designated space at the curb, or a widened shoulder for the bus to stop.

The best practice at all bus stops (whether urban, suburban, or rural), is to provide a design that maximizes pedestrian convenience, safety, and security, as well as one that will attract pedestrian use over time. See previous guidance in this section for more information about design of transit waiting areas and refer to local guidelines. For example the City and County of Honolulu Department of Transportation Services provides Bus Stop Improvement and Design Guidelines. These guidelines include minimum standards for applying passenger amenities to bus stops based on location, wait times, and extent of use. Exhibits 6.11 through 6.13 illustrate bus stop design recommendations. Exhibit 6.15 illustrates preferred best practices for rural area bus stops. Refer to Exhibit 6.14 for the HDOT design standard for a bus bay.

Since this sidewalk to platform ramp exceeds 5 percent, handrails are required to comply with ADA Standards; Eugene, OR.

Bus stops provide designated space for loading and unloading passengers. A bus bay length that accommodates one bus is normally from 40 to 80 ft in length, and may be longer in business districts with high levels of use. Bus stops and loading zones accommodating multiple buses can be much longer. The Maui County Bus Stop Planning and Design Services report recommends a minimum curbside clearance of 40 ft along the length of the bus stop. (See Exhibit 6.11.)

Bus stops can be designed to accommodate buses stopping in-lane to pick up passengers or buses moving out of lane into a pull out area.

Transit agencies in urban areas throughout the United States are trending away from constructing pull out areas because of their impact to service efficiency.

EXHIBIT 6.11 *Bus Shelter Placement*

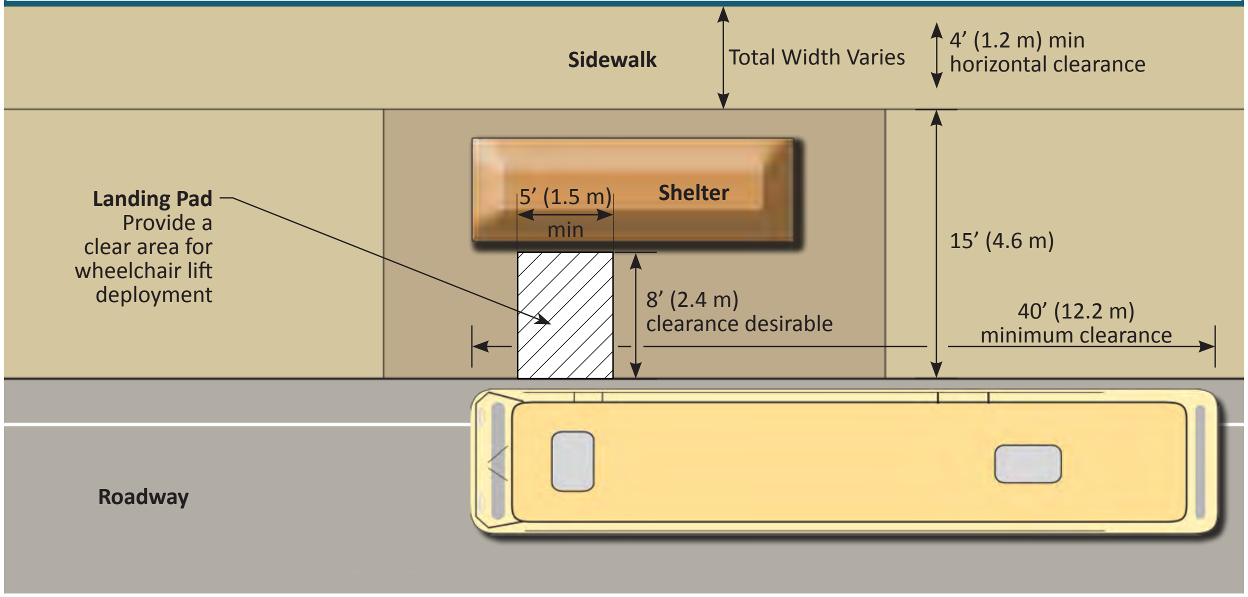


EXHIBIT 6.13 *Bus Shelter Amenities*

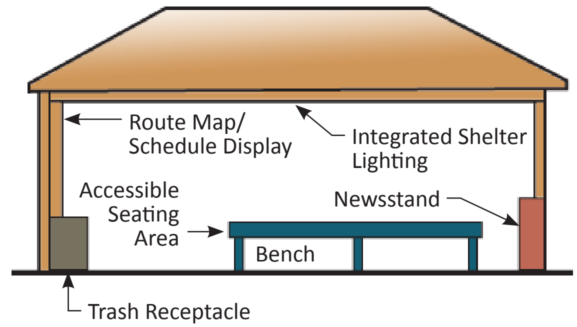


EXHIBIT 6.12 *Bus Shelter Placement on Narrow Sidewalks*

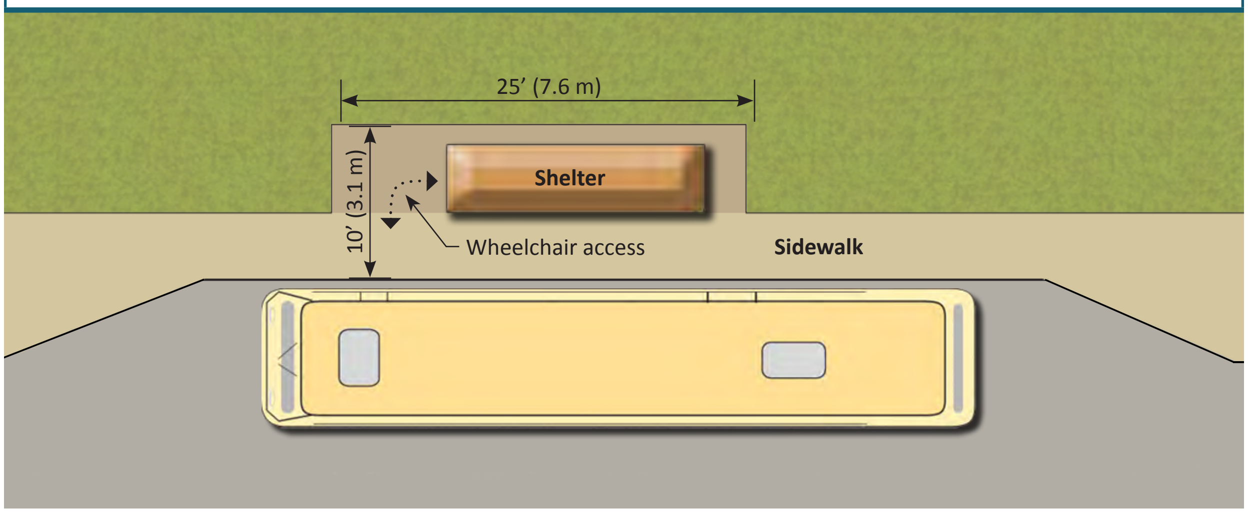
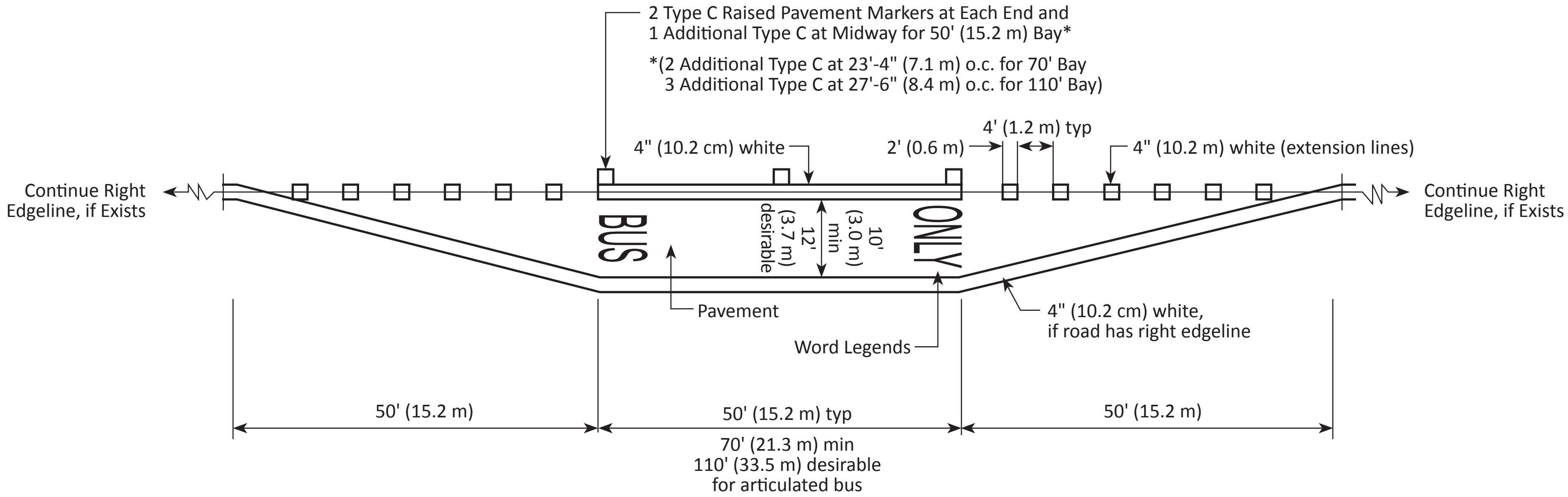


EXHIBIT 6.14 **HDOT Bus Bay - Standard Plan TE-28A (7/11/08)**



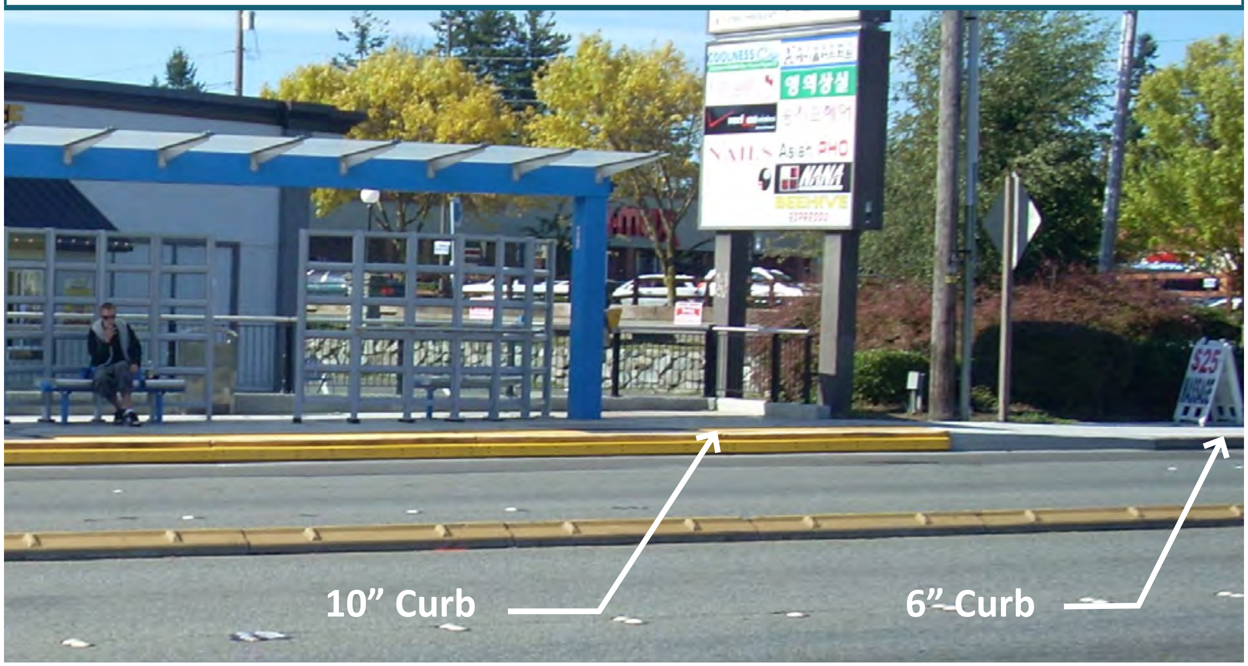
The boarding and exiting of bus passengers should not conflict with pedestrian and bicycle movement. Curb bulb-outs at the intersection can help reduce conflicts with pedestrians, bicycles, and vehicles. Actions that cause frequent delays to other vehicles should be avoided, and where road space is limited, a narrower curb bulb should be considered. Pull outs should be designed to meet roadway conditions and bus characteristics, and allow buses to pull up directly adjacent to the curb.

Additional guidance specific to pedestrian waiting areas adjacent to transit stops and bus pull out areas is provided below. Some of this guidance reinforces points previously made regarding overall design of pedestrian access to transit facilities, but is specific to bus stop areas.

- Along the paved area adjacent to the bus stop, provide a minimum four-foot-wide clearance zone measured perpendicular to the curb, so that opening bus doors are not blocked by street furnishings, sign posts, landscaping, or other obstructions.
- Provide ADA compliant sidewalks (pedestrian access routes) leading to and from the bus stop as part of complete street improvements (see Toolbox Sections 2, 3 and 4 for more information).
- Provide open sight lines and avoid placing shelters, furnishings, and vegetation that may obstruct driver and waiting passenger views.

- Shelters should be well-lit and constructed of materials that do not obstruct views out of or into the shelter.
- Transit stops should include sheltered, visible, and comfortable seating areas and waiting spaces set back from the walkway. Where there is no room to provide a seating area, a leaning rail could be provided. Protection from rain, sun and wind are important considerations.
- Adequate drainage facilities should be provided at all transit stops. Poor drainage can result in water 'ponding' on the walkway around the passenger waiting or boarding area, creating an undesirable environment and safety hazard.
- Transit riders need to be able to cross the road safely at transit stops. On a typical two-way street, with residences and development on both sides, half the riders will need to cross the road when boarding or exiting the bus. Mid-block crossing facilities should be provided at mid-block bus stop locations. See Toolbox Section 5—Intersections and Crossings for additional information.

EXHIBIT 6.15 ***Sidewalk Ramping from a 6 in (15.2 cm) Curb Height to a 10 in (25.4 cm) Platform Height***

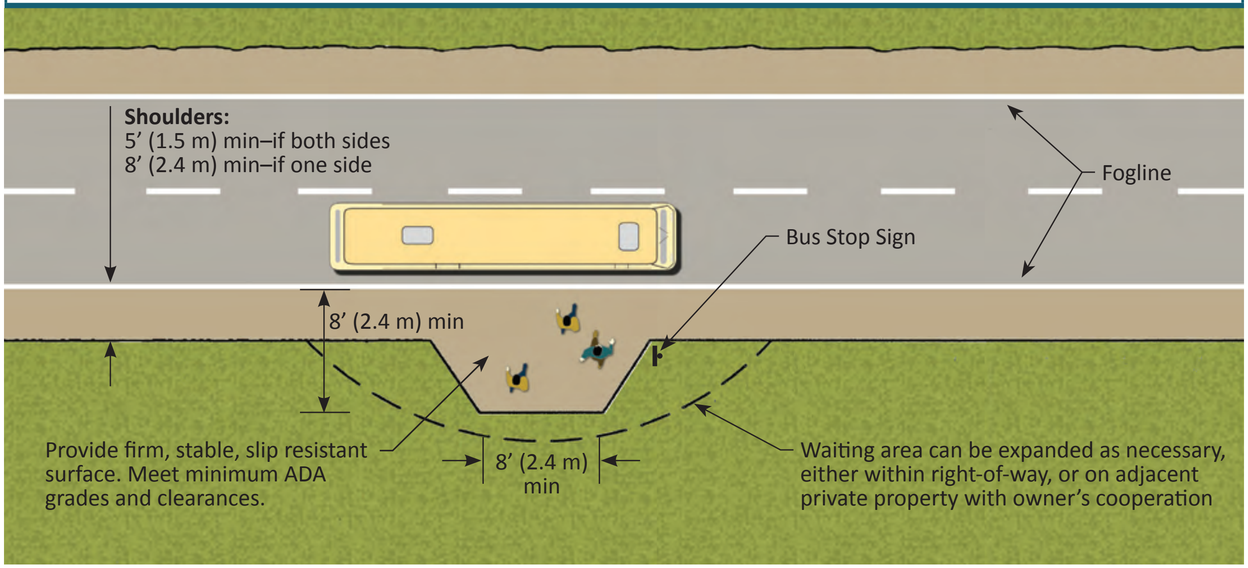


- Curb heights should never be higher than the height of the bus step to prevent falls during passenger boarding and departing. Older buses tend to have a bottom step that is 14 in (35.5 cm) to 18 in (45.7 cm) above the roadway. Newer buses can have bottom steps as low as 11 in (27.9 cm) above the roadway. The City and County of Honolulu standard curb height is 5 in (12.7 cm) minimum. Avoid locating bus stops where there are curbs of varying heights.
- At locations with curbside parking, extending a portion of the sidewalk out to the travel lane allows most of the curbside parking to remain, while providing a connection between the travel lane and the sidewalk, so waiting passengers can easily access the bus. Bulbs maximize the amount of on-street parking around bus stops while minimizing needed curb clearance.

Louvered panels provide shade at this Phoenix light rail station.

- Bus stop design should avoid conflicts with through pedestrian travel along the route. Sufficient space should be provided adjacent to stops/shelters so that through-traveling pedestrians can easily pass passengers waiting to board. American Association of State Highway and Transportation Officials (AASHTO) guideline recommendations for designing bus stops adjacent to bike lanes include:
  - Bicyclists require a minimum operating space of 4 feet. Where motor vehicle traffic volumes and the mix of bus and truck traffic increase, a more comfortable operating space of 5 feet or more is desirable.
  - Bicycle parking should be provided at all transit stations and bus stops.
- When there is a planting strip directly adjacent to the curb, extend the paving/sidewalk slab in this area adjacent to the transit stop from the existing sidewalk to the curb so that passengers do not have to cross wet grass or mud during inclement weather.
- Strategically locate bus stops to minimize crosswalk movements of transferring passengers where transfer movements between bus routes are heavy. For heavy transfer movements, locate bus stops on the same corner of an intersection so users are not required to cross the street.
- On streets with parallel parking, users of near-side bus stops can benefit from elongated curb bulb-outs/extensions that provide passengers adequate area to board or exit the bus without having to step into the street or the stream of pedestrian travel on the adjacent sidewalk.

EXHIBIT 6.16 ***Rural Bus Stop Preferred Best Practices***



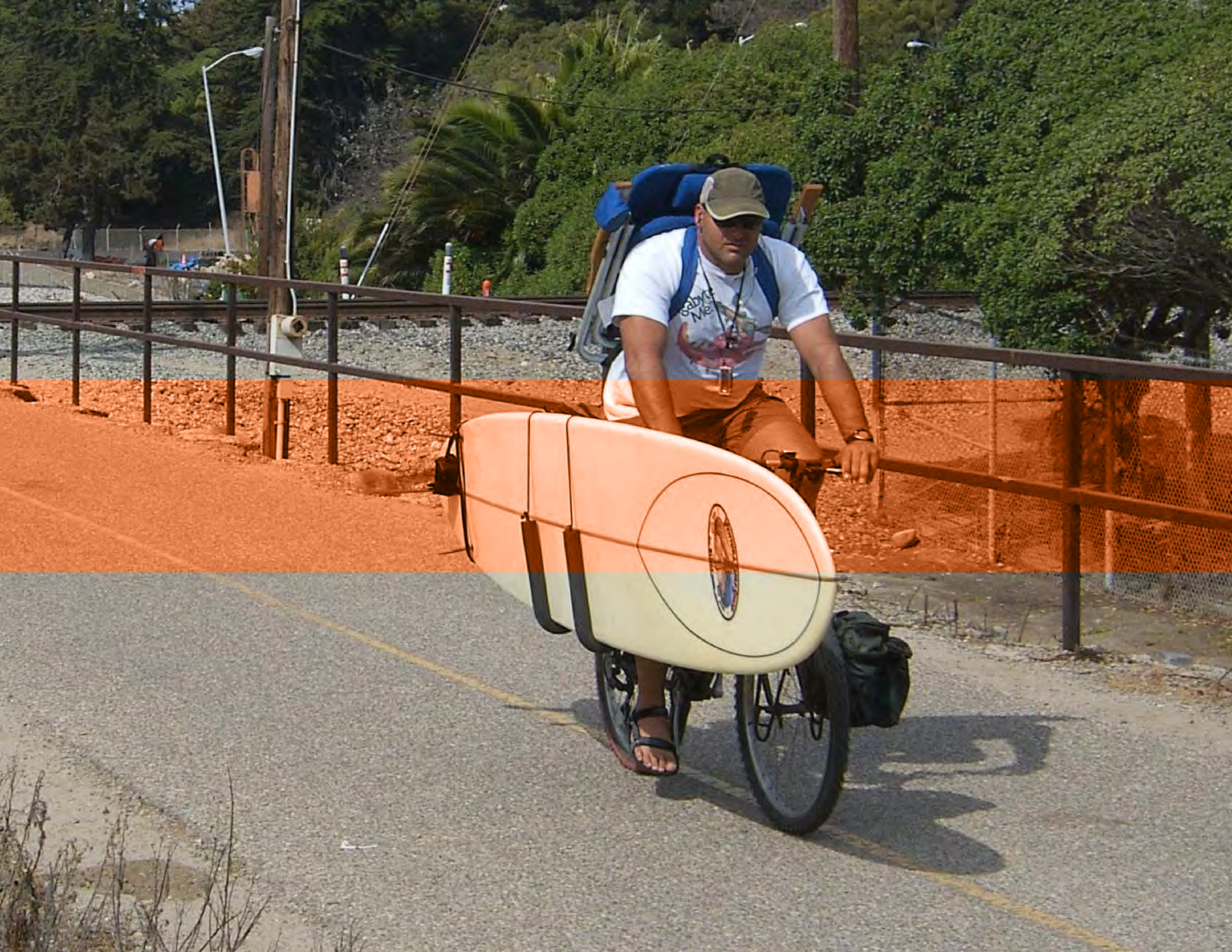
Remember to provide a space for wheelchairs in the passenger waiting area of all transit stops. If a shelter is provided, the wheelchair space should be within the covered area.

Other Resources

The following resources of information are recommended to guide planning and design that enhances pedestrian access to transit.

- American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Planning, Design and Operation of Pedestrian Facilities.* 2004.
- American Planning Association, Wiley & Sons, Inc. publishers. *Planning and Urban Design Standards.* 2006.
- Center for Livable Communities. *Building Livable Communities: A Policymaker's Guide to Transit-Oriented Development.*
- Central Phoenix/East Valley Light Rail Transit Project, Valley Connections. *Urban Design Guidelines.*
- City and County of Honolulu, Department of Transportation Services, *Bus Stop Improvement and Design Guidelines.*
- Federal Highway Administration. *Manual on Uniform Traffic Control Devices.* 2009.
- Hawaii Disability and Communication Access Board. *Honolulu Rail Transit Station Facility Access Information.*
- Livable Communities Initiative. *Planning, Developing, and Implementing Community Sensitive Transit.*
- Maui County/Maui Bus. *Maui County Bus Stop Planning and Design Services.*
- Municipality of Metropolitan Seattle. *Metro Transportation Facility Design Guidelines.*
- Orange County Transportation Authority Transit Programs Department. *Using GIS for Transit Pedestrian Access Analysis.*
- Project for Public Spaces, Inc. *The Role of Transit in Creating Livable Metropolitan Communities.*
- Puget Sound Regional Council. *Creating Transit Station Communities–A Transit-Oriented Development Workbook.*
- Replogle, M. and Parcells, H. *Linking Bicycle/Pedestrian Facilities with Transit.*
- Rubenstein, Harvey M. *Pedestrian Malls, Streetscapes, and Urban Spaces.*
- SE Wisconsin Regional Light Rail Transit Study. *How to Promote and Enhance Urban Development Around Light Rail Transit Stations.*
- Tri-Met, Tri-County Metropolitan Transportation District of Oregon. *Bus Stop Placement and Design and Planning and Design for Transit.*
- United States Access Board. *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way.* 2011. Website: **http://www.access-board.gov/** (May 2013).
- United States Access Board. *ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).* (Reference for applicable requirements to school site design) Website: **http://www.access-board.gov/adaag/html/adaag.htm** (May 2013).
- Untermann, Richard K. *Accommodating the Pedestrian, Adapting Towns and Neighborhoods for Walking and Bicycling.*
- Wilbur Smith Associates. Non-Motorized Access to Transit, Final Report and Technical Appendices.

The Waikiki Trolley



TOOLBOX SECTION 7

Shared Use Paths

Shared use paths serve the needs of a variety of pedestrians.

SHARED USE PATHS

Shared use paths are typically designed to accommodate pedestrians and bicyclists. They commonly serve the needs of a variety of pedestrians, including commuters, school children, neighborhood residents, wheelchair users (and other individuals with disabilities and mobility or navigation challenges), and recreational users such as joggers and skaters.

Shared use paths may be located within roadway rights-of-way or separated from roadways in independent alignments, such as within utility easements, or along canals and waterfronts. They may also be located in parks and greenways, in open spaces, planned residential communities, and subdivisions. A wide pedestrian mall or corridor within private developments or campuses may also be considered a shared use path.

Beyond creating physical connections, shared use paths have become prominent in the national dialogue concerning the health and welfare of people and the environment. Providing shared use paths supports national efforts to improve fitness and health and provide connectivity and livability in communities. Shared use paths also provide a viable option for commuter travel.

Investment in shared use paths to facilitate pedestrian and bicycle travel will produce significant environmental, livability, health, and economic benefits in Hawaii. This is especially true for residents. The timing is right for a truly integrated mobility strategy for Hawaii that includes new and improved shared use paths in needed areas.

While this toolbox section primarily addresses shared use paths, it also touches on a few considerations related to recreational trails. Shared use paths and recreational trails both provide important linkages in a well-designed pedestrian system.

Planning for Local and Regional Connectivity

Planning of shared use paths should be integral to the planning of overall community and regional transportation systems. The planning process needs to address a broad spectrum of considerations, including but not limited to:

IN THIS SECTION

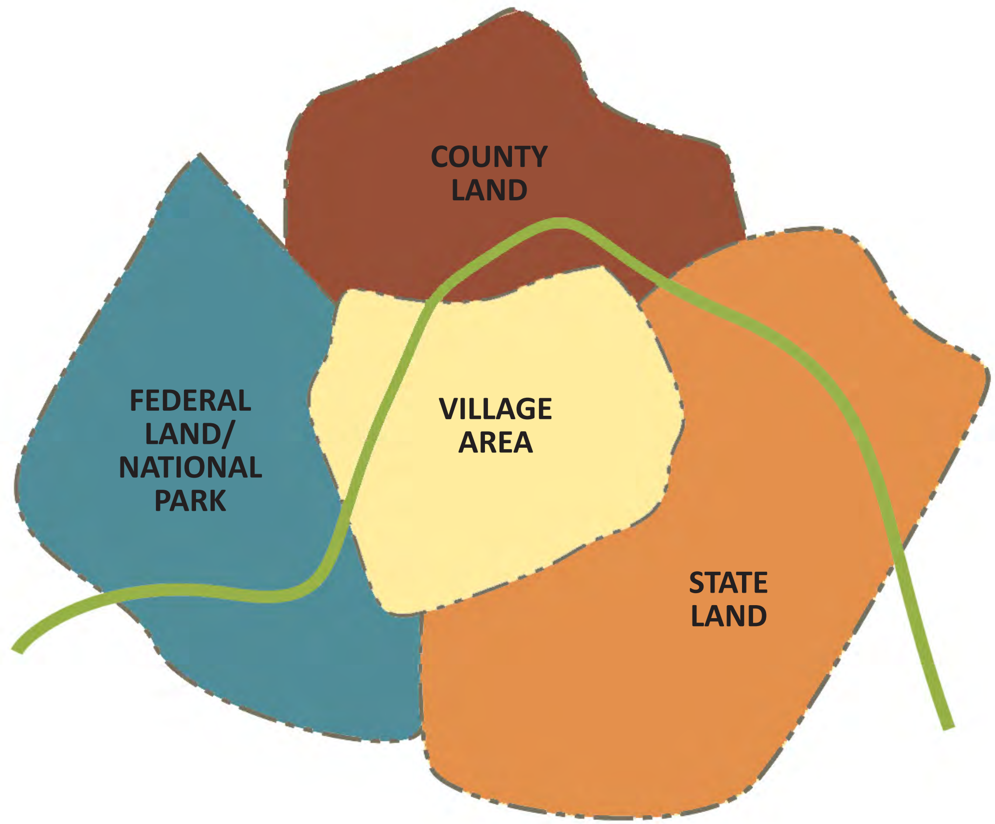
- Local and regional connectivity
- The mobility and safety needs of multiple user groups
- Minimizing conflicts between users
- Street/roadway crossing treatments
- Time periods of use
- Security and visibility
- Other issues

When well planned, designed, and maintained, shared use paths can enhance pedestrian and bicycle mobility and regional connectivity. They can provide convenient routes of travel within communities linking popular origins and destinations such as neighborhoods, parks, schools, community centers, and shopping areas, and can also facilitate access between communities.

The Importance of a System-Wide Approach

Shared use paths may not always be the most appropriate solution or an adequate substitution for a full system of on-street non-motorized improvements (such as sidewalks and bike lanes).

EXHIBIT 7.1 *Jurisdictions must work together to create successful shared use path and trail systems.*



In many communities, commuting bicyclists prefer to ride within the public right-of-way rather than adjacent to it on a shared use path combined with pedestrians. Pedestrians also often prefer to walk on facilities that are not shared with bicyclists. On the other hand, in communities where there are families with young children, shared use paths separated from the street may be a preferred alternative for slower-moving bicyclists and kids on smaller bicycles and scooters. Shared use paths also often serve important recreation and fitness needs in communities. See Toolbox Section 3—Pedestrian-Friendly Streets for more information on Complete Streets.

The Importance of Public Involvement and Cross-Jurisdictional Coordination

Because shared use paths can serve as important linkages in the overall non-motorized transportation system, public involvement and coordination between jurisdictions are essential when planning these facilities. For example, jurisdictions in Hawaii may include federal land managers, state lands, county ownership, City and County of Honolulu, and other governmental agencies, as well as private land owners. Interactions between these land owners and jurisdictions can help planners and designers better understand who will use the shared use paths, what land uses they will connect, how they will fit within the overall transportation system, and how they will meet each jurisdiction's specific needs and requirements.

Because of their linear nature, shared use paths and trails often cross over boundaries of multiple jurisdictions (state, county, city, and federal rights-of-way and private lands). Cooperative coordination between jurisdictions for the planning, design, operation, and maintenance of the facilities is essential. Communities can benefit from working together to coordinate improvements and linkages for region-wide non-motorized path and trail systems.

Hawaii's Department of Land and Natural Resource's Na Ala Hele Trail and Access Program pursues this goal for recreation trails specifically. Path and trail project planners should contact Na Ala Hele early in the project scoping process to ensure planning commences with full awareness of legal, historical, and jurisdictional issues related to recreation trail planning.

Shared Use Paths and Recreation Trails

Shared use paths and recreation trails provide transportation and recreational opportunities to variety of users. Refer to Exhibits 7.2, 7.3, 7.4, 7.6, and 7.7 for shared use path and recreation trail illustrations.

The distinctions between shared use paths and recreational trails have to do with their purpose, primary use, and design. Shared use paths are designed primarily for transportation and their primary users are pedestrians, bicyclists, and users of mobility devices such as manual and motorized wheelchairs. Their design is similar to roadway design except on a smaller scale and at much lower speeds. Recreation trails are designed primarily for recreational purposes, and not for transportation. Refer to the ***Shared Use Path Accessibiity Guidelines*** (SUPAG), Advance Notice of Public Rulemaking (ANPRM) for more information.

Shared use paths are generally paved and evenly graded, whereas recreational trails and off-road trails may not be paved at all and may have only minimal grading improvements. While these distinctions may be helpful in determining design parameters for the facility, it must be remembered that users don't always recognize them. A jogger may use a shared use path for recreation, and a mountain biker may do a partial commute on a recreation trail.

Recreational trails may also include pedestrian-only paths and unpaved paths found in parks and open spaces, as well as in undeveloped and natural areas. Unpaved paths are best used for areas with low use and limited purposes or as interim solutions until they can be fully improved. Exhibit 7.5 further compares shared use paths with recreational trails.

EXHIBIT 7.2 ***Paved Shared Use Path***

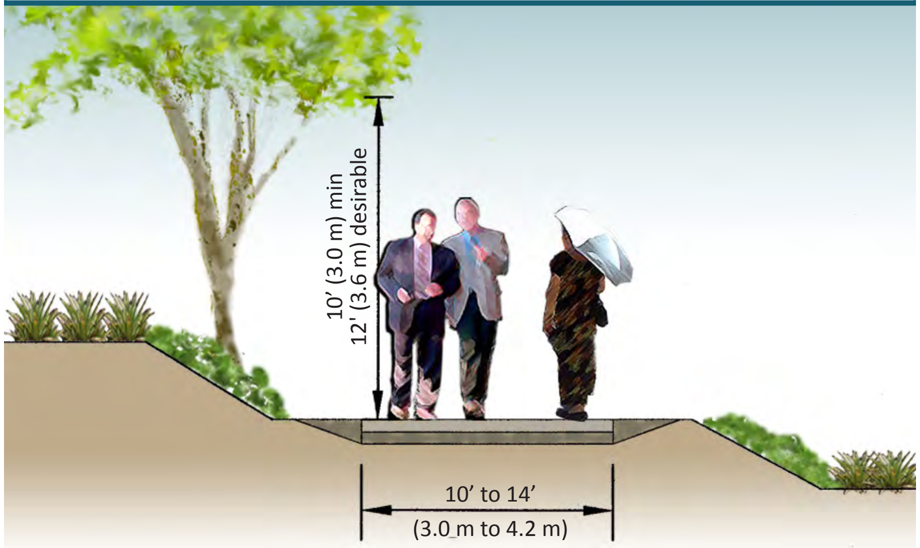


EXHIBIT 7.4 ***Unpaved Pedestrian-Only Path or Trail***

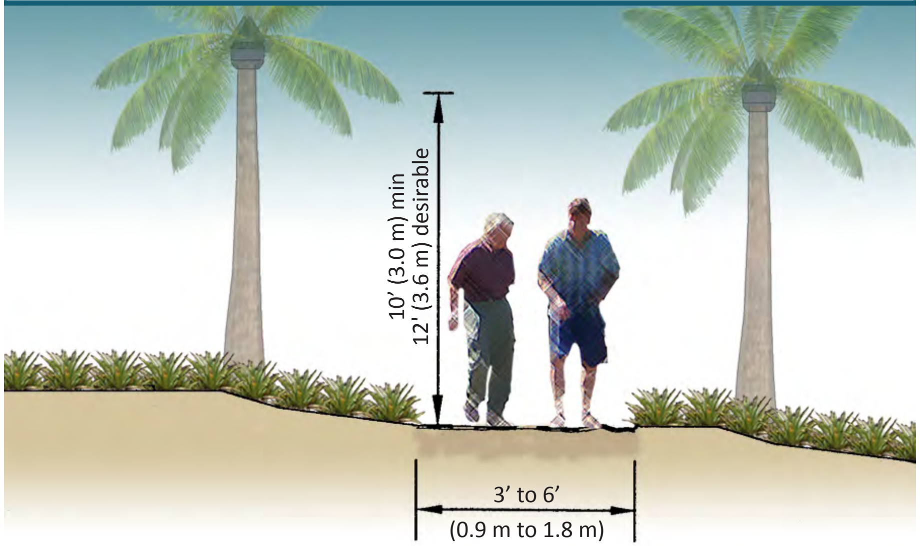


EXHIBIT 7.3 ***Unpaved Shared Use Path***

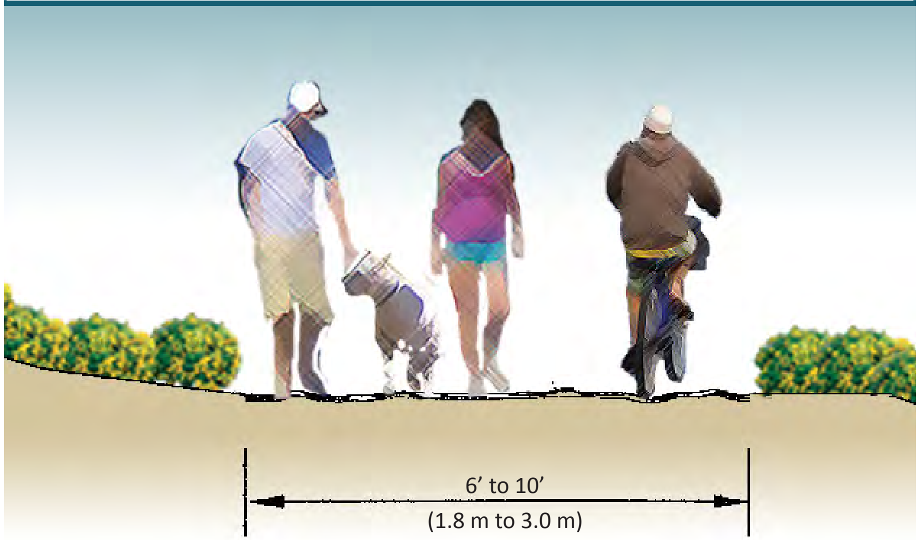


EXHIBIT 7.5 Comparison of Shared Use Paths and Recreation Trails

SHARED USE PATHS	RECREATION TRAILS
Multiple users at multiple speeds	Generally walking speed only
Usually paved	Usually not paved
Used for transportation and recreation	Used primarily for recreation
Design accommodates pedestrians, wheelchair users, bikers, skaters, skateboarders, joggers, and bicyclists	Design accommodates pedestrians, and sometimes equestrians and mountain bikers
May be required to meet Americans with Disabilities Act (ADA) standards. Should comply with the applicable accessibility guidelines (PROWAG or SUPAG) as best practice. *(Note: Hawaii's Disabilities and Communication Access Board allows pedestrian facilities to follow topography.)*	Should be designed to provide accessibility as part of an outdoor recreation experience, including use by people in wheelchairs. Best practice is to comply with US Access Boards' Outdoor Developed Area Accessibility Guidelines (ODAAG)
Motor vehicle access may be needed (typically for emergency and maintenance vehicle access only)	Not usually designed to allow motor vehicles

This toolbox primarily focuses on considerations related to the design of shared use paths. There are various other resources that address considerations related to the planning and design of recreational trails (see "Other Resources" at the end of this toolbox).

In addition to the guidance in this toolbox section, shared use paths in Hawaii also should be designed in compliance with guidelines in Bike Plan Hawaii and the soon to be completed Oahu Bike Plan.

Compliance with the Americans with Disabilities Act (ADA)

Paths and trails provide important transportation alternatives and outdoor recreational opportunities for everyone. It is always the best design practice to apply universal design principles, providing paths and trails as accessible facilities. Paths and trails within public rights-of-way that are part of a designated Pedestrian Access Route (PAR) must comply with Americans with Disabilities Act (ADA) requirements. See Toolbox Section 3—Accessibility for more information on PARs.

Designing shared use paths that meet the gradient and dimensional requirements to accommodate bicyclists generally also meets the requirements for ADA. Even if the path is not a designated pedestrian access route or accessible route of travel, the best practice is to design the facility to meet ADA requirements. If the path is not functioning as an accessible route of travel between buildings and facilities and cannot be designed to be fully accessible due to topography or other physical site constraints, it may be exempt from some of the design requirements related to the ADA.

UNIVERSAL DESIGN

Universal design is "The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." The seven principles include: equitable use, flexibility in use, simple and intuitive use, perceptible information; tolerance for error; low physical effort; size and space for approach and use.

- The Center for Universal Design at North Carolina State University.

Check with the HDOT, the Hawaii Disabilities and Communication Access Board (DCAB), the US Access Board, Federal Highway Administration (FHWA), and the local jurisdiction of the project to determine if your project is eligible for certain exemptions from the ADA design provisions.

US Access Board Design Guidelines

The US Access Board has issued guidelines for both shared use paths (SUPAG) and recreation trails. The SUPAG include clarifying definitions of shared use paths and recreation trails, as well as technical provisions for shared use path design. An ANPRM has been issued and is currently in a period of public comment. Guidelines for recreation trails and beach access are included in the Access Board's ***Outdoor Developed Areas Accessibility Guidelines*** (ODAAG). The Draft Final Guidelines are available at the Access Board website.

Providing Accessibility and Preserving the Environment

Because of the challenges inherent in balancing the goal to provide access with the goal to minimize disturbance of natural resources, the US Access Board has identified four conditions where departure from the technical provisions for accessibility are permitted in the design of recreation trails and beach access. These exceptions apply where adherence to accessibility guidelines in trail construction:

1. Would not be feasible due to terrain
2. Cannot be accomplished with the prevailing construction practices
3. Would fundamentally alter the function or purpose of the trail or setting
4. Is precluded by: the Endangered Species Act, the National Environmental Policy Act, the National Historic Preservation Act, The Wilderness Act, or other Federal, State, or local law the purpose of which is to preserve threatened or endangered species; the environment; or archaeological, cultural, historical or other significant natural features

For more accessibility design guidelines and information related to the ADA, refer to Toolbox Section 3—Accessibility.

Path Components, Dimensions, and Other Design Treatments

General Design Considerations

Paths for exclusive pedestrian use should be designed to meet the same clearances and dimensional guidelines as pedestrian sidewalks. Exhibit 7.6 shows a typical shared use path, and Exhibit 7.7 shows the major components of shared use paths. Shared use paths for pedestrians and bicyclists need to be designed with dimensions appropriate for shared use, proper horizontal and vertical curvature, stopping distances before crossings, and other requirements. Often the biggest challenge in the design of shared use paths is accommodating multiple user groups and minimizing conflicts that can arise with the shared use of one facility.

EXHIBIT 7.6 ***An accessible path can be enjoyed by all kinds of users.***

Components

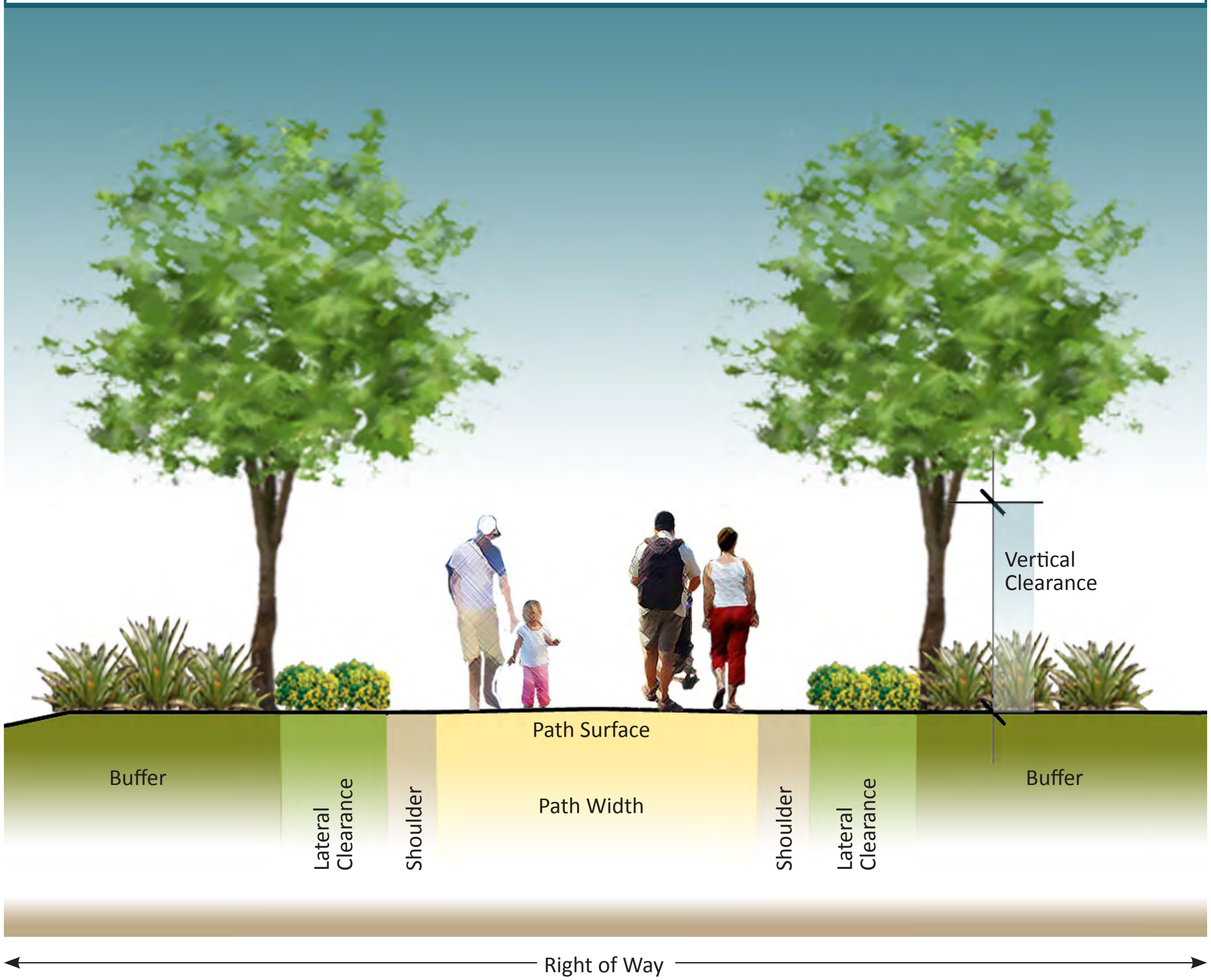
Path corridors include various components:

- The path itself, width, level of vertical clearance provided, and surfacing treatment;
- Lateral clearance areas , which are the additional level, clear spaces beyond the shoulders on each side of the path; and
- Shoulders on both sides of the path;
- The buffer area or separated distance between the path and the outside edge of the corridor, the adjacent roadway edge or other feature. The buffer zone often contains landscaping, trees, and/or open space.

Dimensions

Dimensions for paths can vary depending on the type of facility, the levels of use, types of users, and the setting. Typical dimensions shown in Exhibit 7.8 for shared use paths are based on the American Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities.* Refer to the AASHTO guide, as well

EXHIBIT 7.7 ***Path Components***



as the *Bike Plan Hawaii*, and the *Oahu Bike Plan* for more information. The recommended dimensions for shared use paths is 12 ft (3.7 m) desired minimum and with 2-ft-wide (0.6 m) shoulders on both sides. A 10-ft-wide (3.0 m) path may be acceptable where right-of-way is restricted, while a 14 ft-wide (4.3 m) path may be best for heavy use. Exhibit 7.8 also lists typical dimensions for recreational trails.

Wider path widths of 11 to 14 ft (3.4 to 4.2m) are recommended in locations where a high percentage of use will be by pedestrians (30 percent or more of the total volume of use), as well as where there will be high use overall (more than 300 total users in the peak hour).

A minimum of 11 ft (3.4 m) in width is needed to enable a bicycle to pass another path user going in the same direction at the same time another path user is approaching from the opposite direction. Wider paths are also recommended where:

- There will be significant use by inline skaters, adult tricycles, children, or other users that need more operating width;
- The path will be used by larger maintenance vehicles;

EXHIBIT 7.8 Recommended Dimensions for Shared Use Paths and Recreation Trails

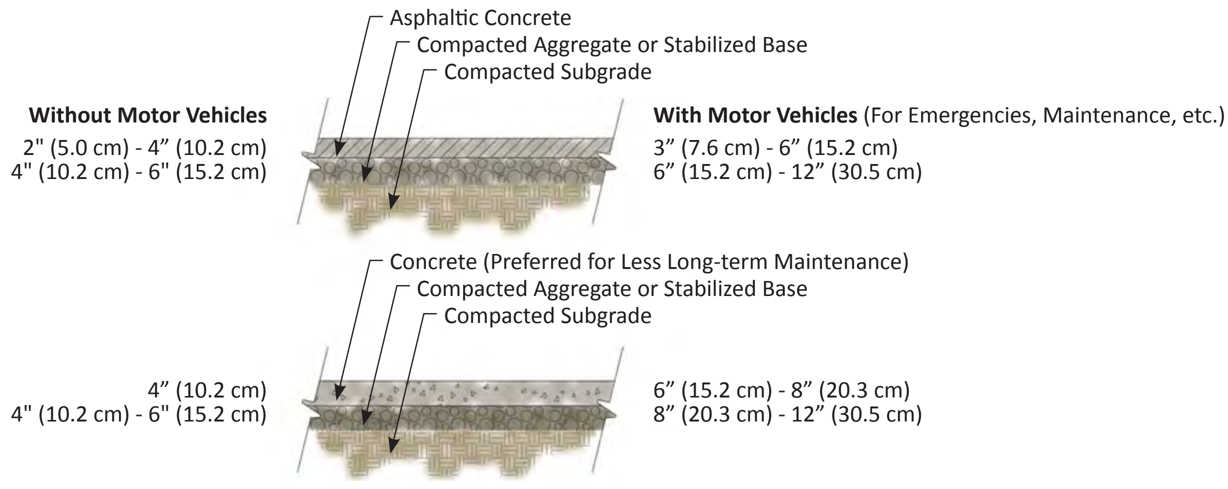
	RECOMMENDED DIMENSIONS			COMMENTS
SHARED USE PATHS				
Path Widths	10' 12' 14'	3.05 m 3.66 m 4.27 m	Minimum Desirable Heaviest Use	Minimum width should only be used where volumes are low and sight distances are good; higher speed users (bicyclists and skaters) and heavier use require greater widths (see AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities).
Buffer/Roadway Separation	5'	1.52 m	Minimum	Minimum separation between the roadway and parallel, adjacent path; a physical barrier should be installed where minimum separation cannot be met (see AASHTO).
Shoulders	1' 2'	.31 m .52 m	Minimum (Peds only) Minimum (Shared Use)	Shoulders provide pull-off, resting and passing space; should be graded to the same slope as the path; minimum shoulder width of 1 ft should only be used in constrained areas.
Lateral Clearances	2' 4'	.52 m 1.22 m	Minimum Desirable	Lateral clearances are additional level and clear spaces on each side of the path beyond the shoulders. All obstructions (e.g. trees, signs, etc.) should lie outside of the lateral clearances.
Vertical Clearances	10' 12'	3.05 m 3.66 m	Minimum Desirable	Additional clearance improves visibility.
Pedestrian Corridor/Mall (Urban Areas, Typically)	10' 12' 14'	3.05 m 3.66 m 4.27 m	Minimum Desirable Min. Heavy Use Min.	Paths in urban areas or those that receive heavy use should be wide enough to accommodate several people walking side-by-side or groups of people walking in opposite directions.
RECREATION TRAILS				
Paved Pedestrian-Only Trail Width	5' 7'	1.52 m 2.13 m	Minimum Desirable	These trails are for exclusive use by pedestrians.
Unpaved Pedestrian-Only Trail Width	2' 4'-7'	0.62 m 1.22-2.13 m	Minimum Desirable	Best as limited purpose facility in rural or semi-primitive areas; can provide interim solution; minimum width should only be used in constrained areas.
Unpaved Shared Use Trail Width	7' 8'-10'	2.13 m 2.44-3.05 m	Minimum Desirable	Suggested only as an interim solution and not appropriate for high use trails; best in rural or semi-primitive areas.
Vertical Clearance	8'	2.44 m	Minimum	Additional clearance improves visibility. Ten ft is minimum when equestrian use is expected.

- On steep grades to provide additional passing area; or
- Through curves to provide more operating space.
- In very rare cases, a reduced width of 8 ft (2.4 m) may be used for a shared use path where the following conditions prevail:
  - Bicycle traffic is expected to be low, even on peak days or during peak hours. (In this case consider leaving space to widen the path in the future as bicycle traffic may increase.)
  - Pedestrian use is not expected to be more than occasional.
  - Horizontal and vertical alignments provide frequent, well-designed passing and resting opportunities.
  - The path will not be regularly subjected to maintenance vehicle loading conditions that would cause pavement edge damage.

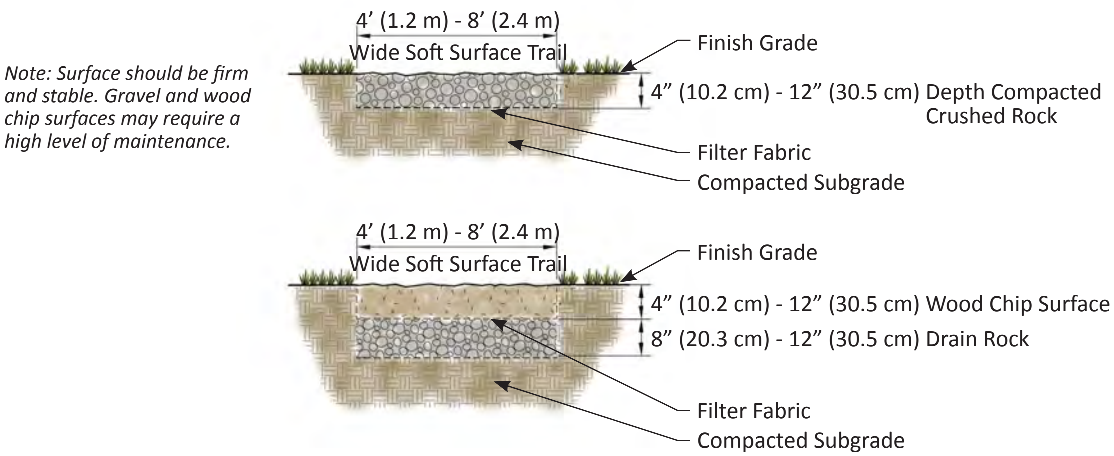
A path width of 8 ft (2.4 m) also may be used for a short distance due to a physical constraint such as an environmental feature,

EXHIBIT 7.9 ***Typical Path Cross Sections***

PAVED SURFACES



SOFT SURFACES



bridge abutment, utility structure, fence, or other element. Warning signs that indicate the pathway narrows per the MUTCD should be considered at these locations.

Paving and Surfacing

When selecting paving and surfacing materials, long-term durability, safety, accessibility, cost, and maintenance are usually the most important criteria.

In general, paths in urban areas should be paved or constructed of hard-surfaced materials. Shared use paths used by pedestrians and bicyclists function best when constructed of a smooth, paved, all-weather surface such as asphalt or concrete, regardless of the setting. Good compaction of the surface and subsurface layers is important to minimize the settling.

All paths and trails need to provide a firm, stable, and slip-resistant surface throughout the primary seasons of use. A good sub-base, such as compacted aggregate material or fully compacted native soil (if structurally suitable), is also important for structural support of shared use paths. Pavement conditions should be checked periodically for potholes or cracks, and repairs should be made when necessary to maintain a smooth surface.

Recommended pavement and surfacing cross sections are illustrated in Exhibit 7.9.

Cross Slope and Longitudinal Grades

Paths and trails can be designed and constructed with various grades, but as previously stated, the best practice is to design shared use paths in compliance with ADA grade requirements. Provide a minimum 2 percent cross slope (see Exhibit 7-11).

In general, longitudinal grades on paths should be kept to a minimum, especially on long inclines. For shared use paths, grades greater than 5 percent are generally undesirable. Where steep terrain exists, grades of 5 to 10 percent can be tolerated for short segments less than 500 ft (152.4 m). On grades exceeding 5 percent, the design speed should also be increased and additional trail width of 3 ft (0.9 m) should be provided for maneuverability. Speed limit signs and signs alerting users to the maximum slope are also good measures. The draft technical provisions for SUPAG also require a maximum grade of 5 percent with an exception that allows the grade to match the street grade where the shared use path is confined within the street right-of-way.

Horizontal Alignment

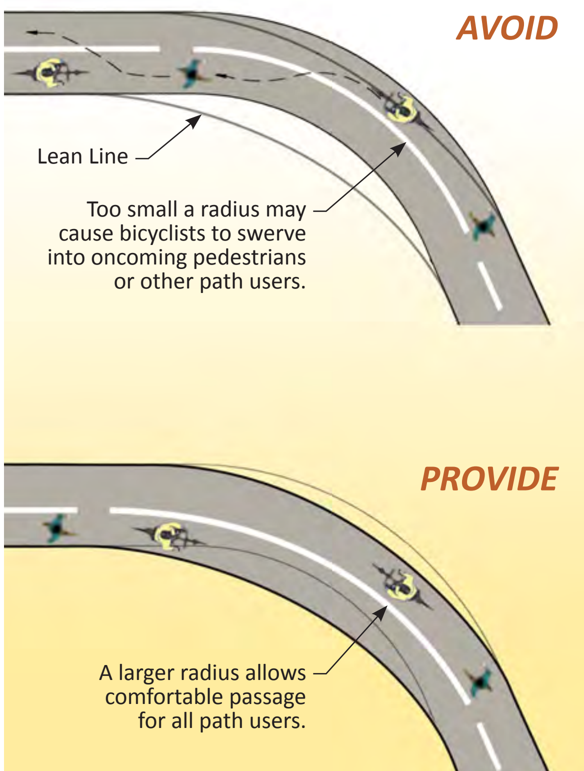
Design of curves for shared use paths should be comfortable and safe for all users. Design speed, the “lean angle” of the bicyclist, available right-of-way, topographical features, and other factors all contribute to curve design. AASHTO bicycle design guidelines should be followed when designing the horizontal alignment of shared use paths. Exhibit 7.10 shows important considerations related to curve radius design for shared use paths.

Shoulders, Side Slopes, and Railings

Recommended widths for shoulders at the sides of paths are provided in Exhibit 7.8. In areas where there are side slopes or ditches, a minimum 4 ft (1.2 m) wide, level clear zone (including the shoulder and lateral clearance area) is needed before any changes in topography (upslope or downslope) on each side of the path.

Beyond the level clear area, swales, ditches, or sloping topography can occur within a shared use path corridor. For adjacent changes in grade, maximum side slopes of 3:1 are recommended.

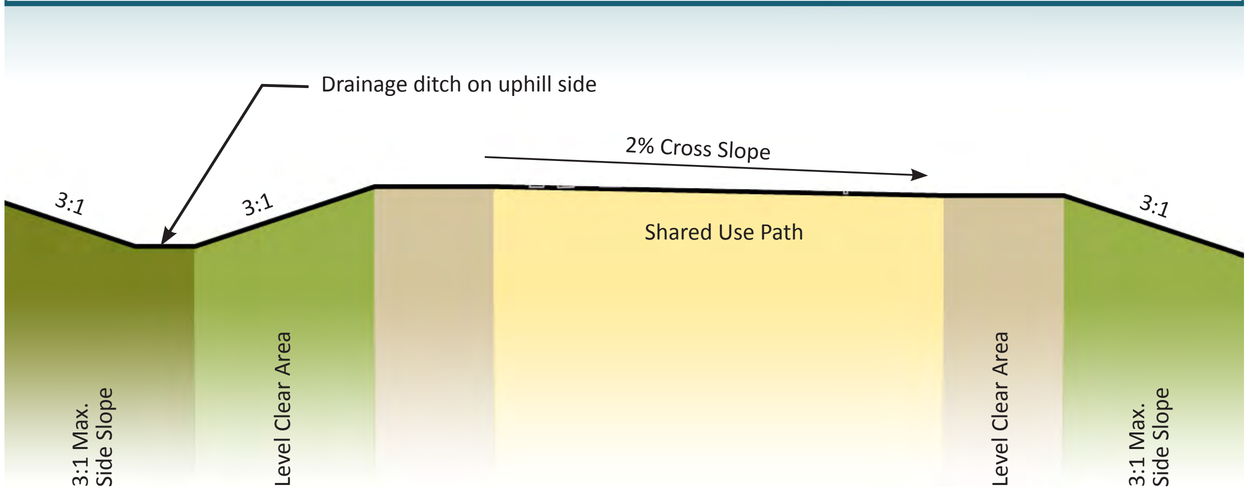
EXHIBIT 7.10 *Horizontal Alignment: Curve radii on shared use paths should follow the minimum guidelines in the AASHTO Guide for the Development of Bicycle Facilities.*



SHARED USE PATHS			
DESIGN SPEED		MINIMUM RADIUS	
mph	kph	feet	meters
12	19	27	8
16	26	47	15
20	32	74	22
25	40	115	35
30	48	166	50

**Design speed is for bicycles, assuming a lean angle of 20 degrees.*
(Table Source: AASHTO Guide for the Development of Bicycle Facilities)

EXHIBIT 7.11 *Typical Path Cross Slope and Drainage*

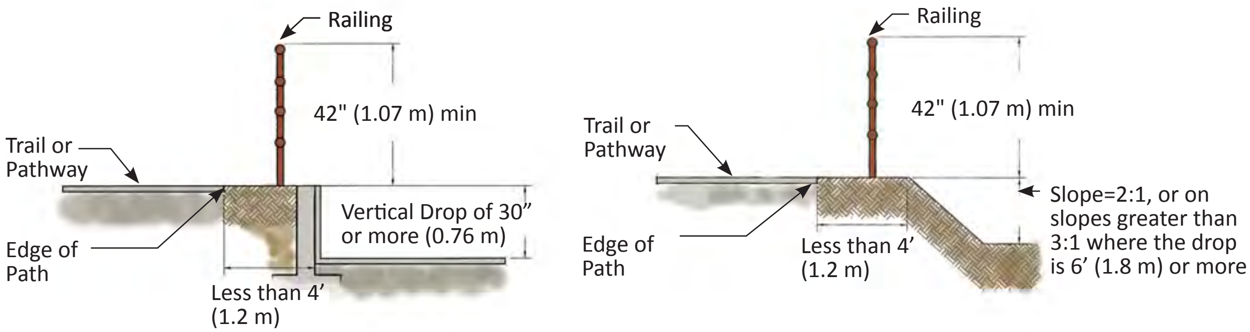


When the grade drops abruptly adjacent to the shoulder/lateral clearance area of a pedestrian or bike travel way, railings are typically required. For shared use paths in urban areas, refer to AASHTO design requirements. Where a vertical drop is more than 30 in, exceeds a down slope grade of 2:1, and is located less than 4 ft (1.2 m) from the edge of the trail, walkway, or sidewalk, a railing needs to be installed along the extent of the grade drop. Exhibit 7.12 illustrates conditions where railing is required. Railings should not be obstructions in the clear zone (including the clear zone of the shared use path and that of the adjacent roadway, as applicable).

Railings adjacent to shared use paths should be a minimum of 42 in (1.07 m) high. Railings are required to be designed with vertical posts, pickets, bars, and top and bottom rails spaced so that a 4 in (10.2 cm) sphere cannot be passed through the spaces (International Building Code). Refer to Toolbox Section 4 for more information.

A maximum 3:1 slope is recommended for steep side slopes on the uphill side of the path corridor. It's best to avoid high retaining walls immediately adjacent to paths since they may be out of scale with creating a pedestrian-friendly environment. Walking adjacent to a very tall,

EXHIBIT 7.12 ***Railing Requirements***



blank wall can be uncomfortable for pedestrians. High walls should be terraced back from the edge of the path shoulder. Blank walls should be screened with landscaping or designed with an attractive face or artwork.

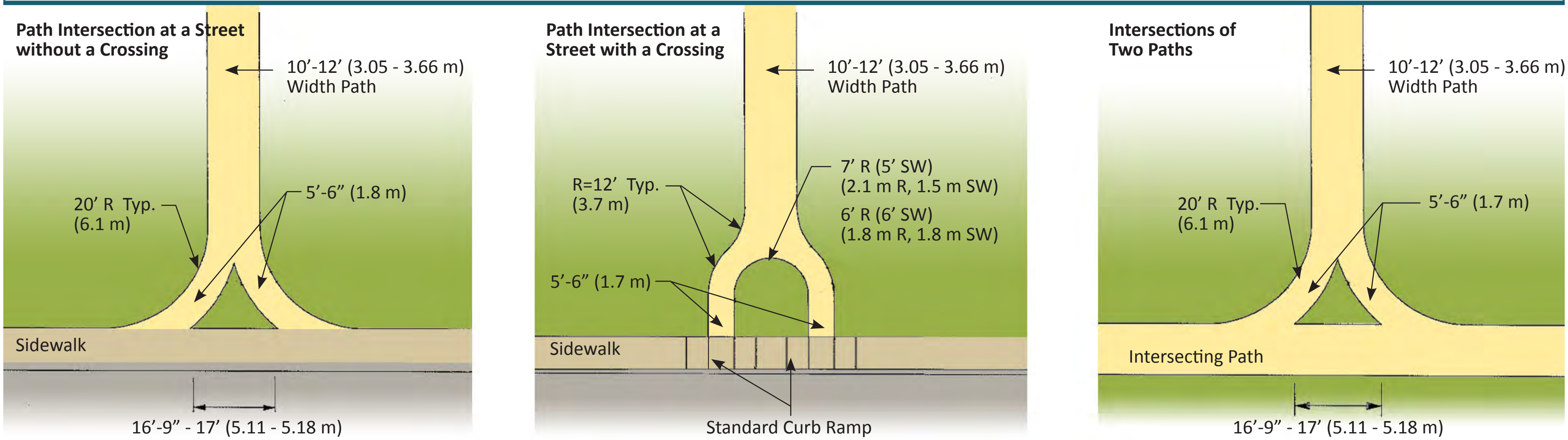
Connections and Crossings

Initial planning of the routes of shared use paths should minimize crossing points with roads and driveways as much as possible. Paths should connect to street systems and destination sites in a safe and convenient manner. Connections should be clearly identified with destination and directional signing.

Where a path that follows a given street encounters a cross street, the path crossing should utilize the normal pedestrian crosswalk at the intersection of the streets. Where shared use paths approach roadway intersections, bicyclists should dismount and cross as pedestrians.

Where an intersecting path and street have orientations that are skewed, a realignment should be made that brings the angle at the intersection as close to 90 degrees as possible. Road crossings that are not close to intersections

EXHIBIT 7.13 ***Path Intersections***



should be designed to mid-block crossing design standards including signage and lighting. (Refer to Toolbox Section 5—Intersections and Crossings.) Exhibits 7.13 and 7.14 show suggested traffic control treatments at path and trail crossings. Exhibits 7.15 shows suggested traffic control treatments for four or more lane road crossings.

Bollard Use and Placement

Bollards are sometimes placed at a shared use path entrance to block motor vehicle access. Refer to the AASHTO Bike Guide (2012) for the most up-to-date guidance for the use and placement of bollards. Marking the bollards with bright colored reflective paint or emblems increases their visibility to pedestrians and bicyclists. Emblems can also be used for trail identification and wayfinding. AASHTO recommends striping or delineating a clear envelope around the bollard to highlight the area to path users (see photo on following page).

The recommended minimum height for bollards is 30 in (76.2 cm). Bollards need to be adequately spaced to allow easy passage by bicyclists, bicycle trailers, and wheelchair users, with one bollard in the center of the trail dividing the two-way traffic flow. If more than the center bollard is needed, other bollards should be placed outside the paved area at trail edges. Removable bollards should be considered to allow access for maintenance and emergency vehicles. See Exhibit 7.16.

Vegetation and Landscaping

The primary objective of landscaping within a path corridor should be identified from the start. The purposes may include screening, aesthetic value, and ecological values. Xeriscaping and climate adapted plants that do not require permanent irrigation are recommended. Plant materials placed along paths also need to be selected to avoid the need for excessive pruning, cleanup of fallen debris, and other maintenance. Native, non-invasive plants are often a good choice. Trees and shrubs with aggressive root systems may raise and buckle adjacent pavement. These types of trees and shrubs should be avoided near paths, or root barriers should be installed. See Exhibit 7.17 and Toolbox Section 11 for further recommendations on the prevention of tree roots buckling walkways.

Signing and Marking

Signage is an important element in design. Signs and wayfinding elements help identify routes, help users find their way from one destination to another, and create an identity for the path,

EXHIBIT 7.14 ***Suggested Traffic Control Treatments where Shared Use Paths Cross Two-Lane Roads***

<table>
<tr><th></th><th colspan="4">AVERAGE DAILY TRAFFIC ON THE ROADWAY</th></tr>
<tr><th>VEHICLE SPEED (85 PERCENT)</th><th><2,000</th><th>2,000-4,999</th><th>5,000-9,000</th><th>10,000+</th></tr>
<tr><td rowspan="2"><= 25 mph (40 kph)</td><td>Yield with traffic calming or Stop sign, calming optional</td><td>Stop sign calming optional</td><td>Stop sign with added traffic calming</td><td rowspan="2">Consider signal</td></tr>
<tr><td>Yield, refuge not needed</td><td>Yield or Stop Refuge optional</td><td>Stop sign with Refuge area or Signal</td></tr>
<tr><td rowspan="2">30-35 mph (50-60 kph)</td><td>Stop sign calming optional</td><td>Stop sign with added traffic calming</td><td rowspan="2">Stop sign with Refuge area or Signal</td><td rowspan="2">Consider signal</td></tr>
<tr><td>Yield or Stop Refuge optional</td><td>Stop Refuge optional</td></tr>
<tr><td>40-45 mph (65-75 kph)</td><td>Stop sign Refuge optional</td><td>Stop sign with Refuge area</td><td>Stop sign with Refuge area or Signal</td><td>Consider signal</td></tr>
<tr><td>50+ mph (80+ kph)</td><td>Stop sign Refuge optional</td><td>Stop Sign with Refuge area</td><td>Consider signal</td><td>Consider signal</td></tr>
<tr><td>When the Path or Trail is Given the Right-of-Way</td><td>When the Roadway is Given the Right-Way</td><td colspan="3">Notes:
• Criteria shown are for two thru lanes. In general, if turn lanes are present, move one cell to the right for each turn lane.
• Yield conditions must satisfy MUTCD Warrant 1. Give precedence to Yield over Stop.
• Path/trail as speed table is acceptable traffic calming for cell <2000/<=25 mph only. For other cells, the traffic calming may be lane narrowing (splitter island/refuge area/ choker) or some other accepted method appropriate to functioning of the roadway.</td></tr>
</table>

Source: Florida Pedestrian Planning and Design Handbook, Refer to the AASHTO Guide for the Planning Design, and Operation of Bicycle Facilities for Additional Guidance.

Intersections between shared use paths and roadways must be designed with care.

A bollard at the entrance to a path prevents unauthorized vehicles from driving on the path.

EXHIBIT 7.15 ***Suggested Traffic Control Treatments on Four (or more) Lane Road Crossings***

SPEED OF AVG DAILY TRAFFIC ON ROADWAY (85%)	<10,000 ADT	10,000-19,999 ADT	20,000+ ADT
<=35 mph (60 kph)	Refuge area, preferably protected	Protected Refuge or Signal	Signal or grade separated
>=40 mph (65 kph)	Protected Refuge or Signal	Signal	Signal or grade separated

Source: Florida Pedestrian Planning and Design Handbook

EXHIBIT 7.16 ***Bollard Placement***

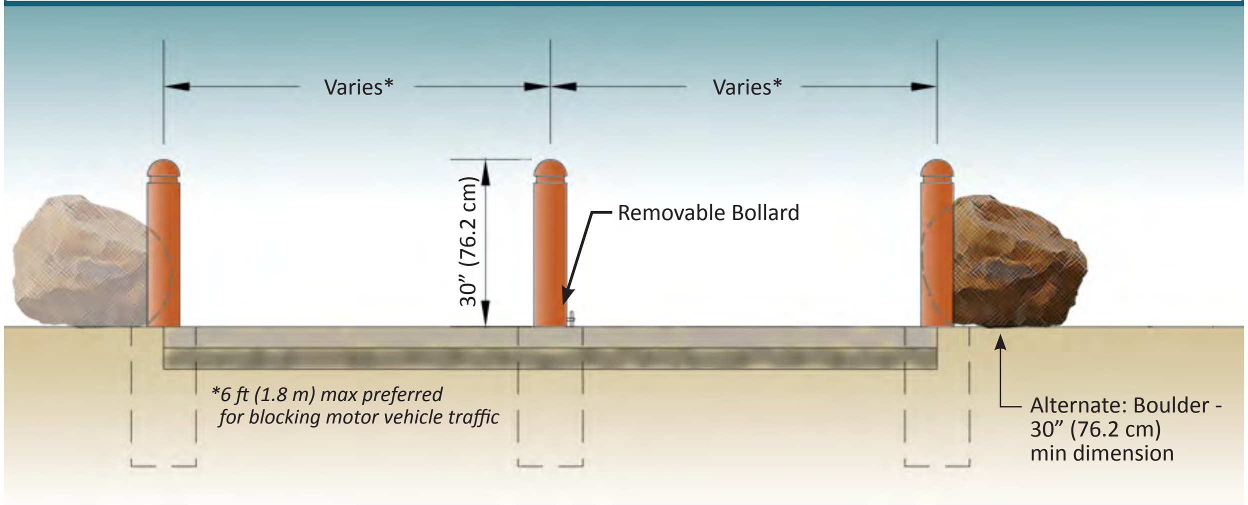
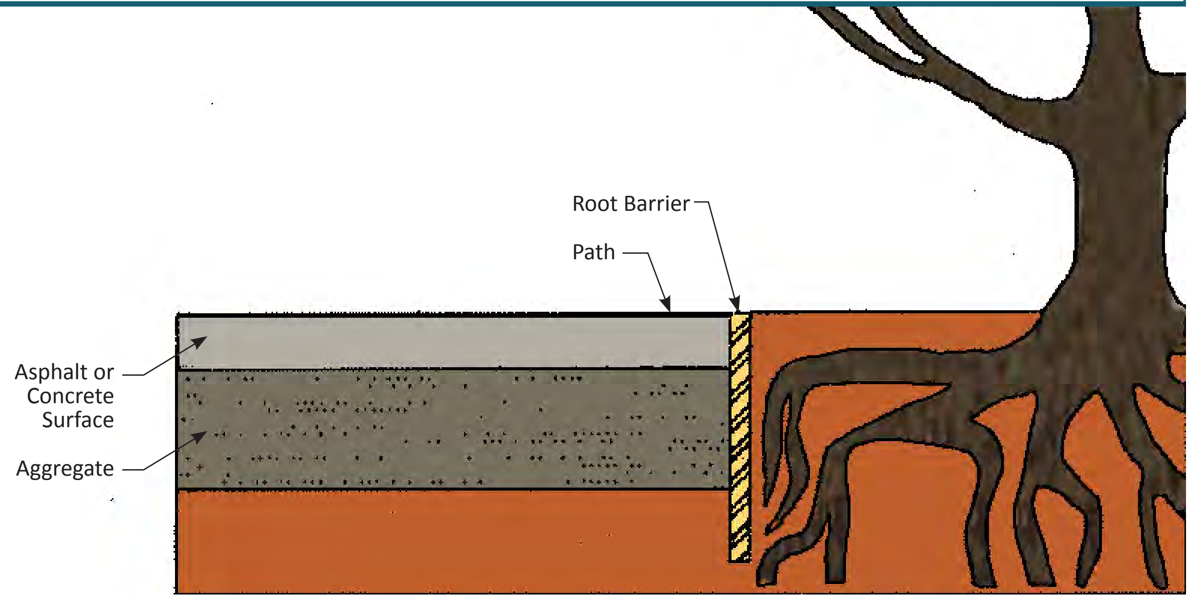


EXHIBIT 7.17 ***Root Barriers Can Prevent Tree Roots from Buckling Paved Path Surfaces.***



pathway system, or even the area the path moves through. Sign designs should be consistent throughout the pathway system, but can also be used to differentiate portions of the path (for example when moving from a trail to a spur, or when crossing jurisdictional boundaries). Milepost markers can also be integrated into the corridor to identify distances between geographic points.

Signs and wayfinding elements can be free-standing or attached to bollards, entry gates, or other entry features.

On shared use paths, regulatory signs are important in addressing safety for path users. Signs should be posted that indicate the speed limit and alert users to conditions that require caution such as curve ahead, steep grades, surface changes, crossing ahead, types of users, and other key messages to path users.

Warning signs should be placed on roadways wherever there is a path/trail crossing. Exhibit 7.18 shows typical trail and crossing signs. Placement should comply with recommendations in the MUTCD. See Toolbox Section 5—Intersections and Crossings for more information. Exhibit 7.19 summarizes guidelines for signing along paths and trails.

Path striping should also be considered for shared use paths (not necessary on pedestrian-only paths) to separate opposite directions of travel. See Exhibit 7.20. Although in most cases, there is no need to segregate pedestrians and bicyclists on a shared use path, even in areas with high volumes of use, consider providing a 4 to 6 in (10.2 to 15.2 cm) wide yellow centerline stripe under the following circumstances:

- On paths where there is a constant, heavy volume of use;
- On curves with restricted sight distance or design speeds less than 14 mph (24 kmh); and
- On unlit paths where night-time riding is not prohibited.

The yellow center stripe should be broken wherever there is adequate sight distance for passing. In other places it should be solid (particularly at curves or where passing bicycles should be discouraged). The material used for pavement markings should be slip-resistant.

EXHIBIT 7.18 ***Trail Crossing Signs***
(Graphic Adaped from 2009 MUTCD)

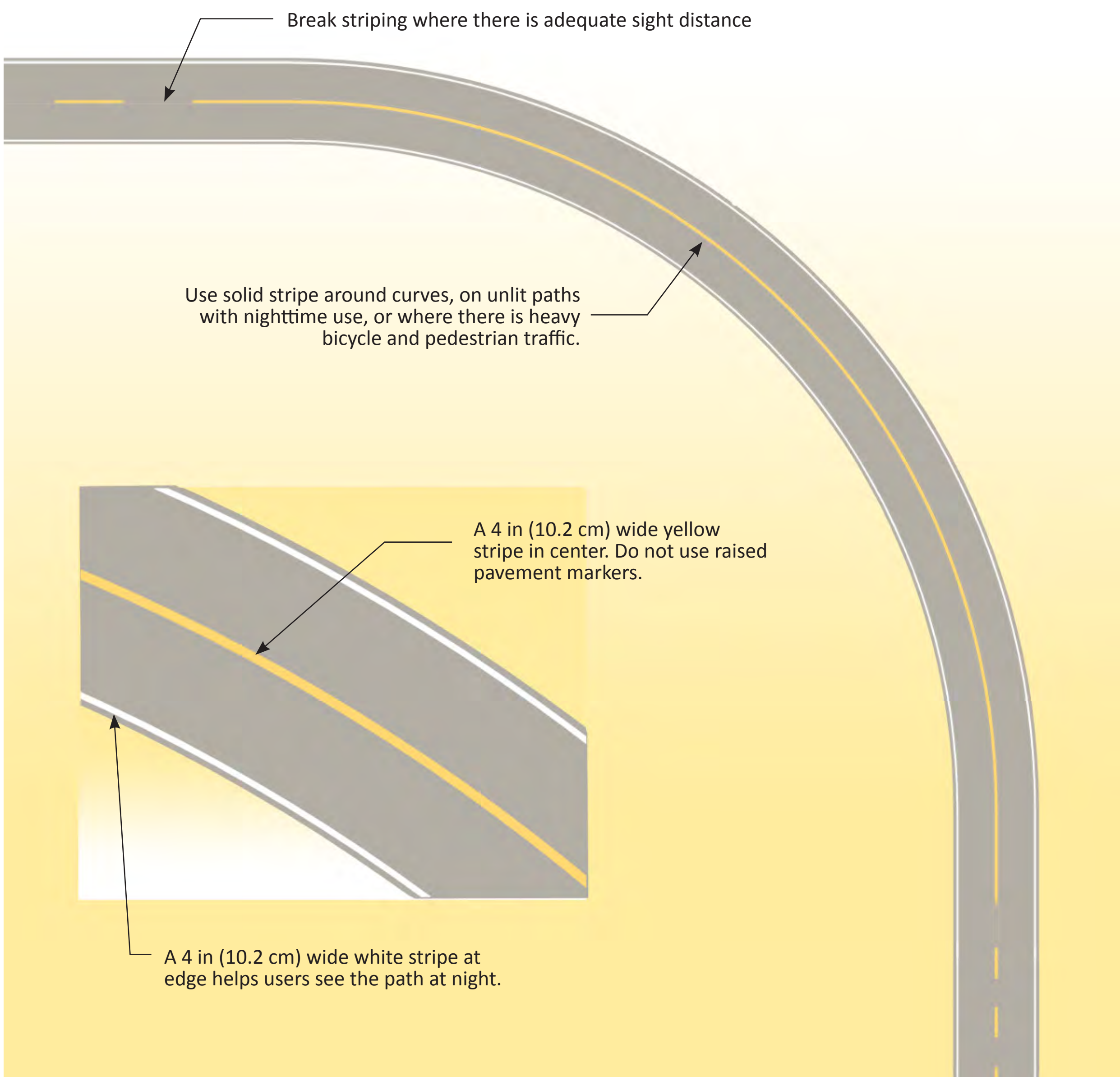
EXHIBIT 7.19 ***Signing Guidelines***

Signs should be low maintenance.
Signs should be vandal proof.
Signage must conform to local ordinances.
Graphic elements and their placement on signs should be consistent.
Signs need to be clearly visible to attract attention, while not being visually intrusive or negatively impacting the scenery.

A curbed median separates bicyclists and pedestrians.

Special paving and markings define uses on this shared use path.

EXHIBIT 7.20 *Striping on Shared Use Paths*



Minimizing Conflicts

Shared use paths are typically designed to accommodate a wide range of speeds and types of motion among pedestrians and bicyclists. Design of shared use paths should carefully consider the characteristics of the different users, such as skill levels, age, speed of travel, and experience.

The mix of pedestrians and bicycles on a shared use path is not always a desirable situation because the potential for conflicts is high. Paths heavily used by commuting bicyclists present problems for pedestrians. Children are particularly at risk on shared use paths because they tend to travel at slower speeds than average bicyclists, and their movements are unpredictable. They may change direction unexpectedly in front of an approaching bicyclist. Conflicts between bicyclists and pedestrians can be avoided by designing the corridor to separate these uses, if possible.

Adequate visibility and sight distance are crucial. Design treatments that can help minimize conflicts on shared use paths are summarized in Exhibit 7.21. In most cases, multiple design treatments will be necessary.

EXHIBIT 7.21 Design Treatments and Activities to Minimize Conflicts on Shared Use Paths

Horizontal and vertical alignment should ensure clear lines of sight for pedestrians and bicyclists.
Sufficient shoulders (2 ft minimum on each side) should be provided to allow space for stopping and resting, as well as passing.
The path should be widened at curves to provide additional space.
Objects that obstruct path users' views at edges of the path should be avoided. Place signs, poles, utility boxes, garbage cans, benches, and other elements away from the edge of the path. Use low-growing landscaping and high-branching trees, or limb up trees. Landscape should be located outside lateral clearance areas.
Signs should be used to indicate bicycle speed limits, directional signing, crossings ahead, and other warnings.
Delineation and separation treatments should be provided such as striping or colored pavement.
Pavement marking (refer to the MUTCD); a 4-in- to 6-in- wide yellow centerline stripe may be considered for shared use paths with heavy volumes of pedestrians and bicyclists, on curves with restricted sight distance, and on paths where night-time use is expected (see Exhibit 7.20). White edge lines can also be beneficial on paths where night-time use is expected.
Educational programs should be provided to promote safe path use.

Providing sufficient space for multiple uses is critical in the design of shared use paths. Exhibit 7.22 illustrates a typical shared use path for pedestrians and bicyclists. Use the wider dimension shown for paths expected to recieve heavy use by pedestrians and bicyclists.

Where right-of-way allows, a separate, soft-surface jogging path may be constructed of compacted crushed gravel or other suitable material, parallel to, but separated from, the paved path (see Exhibit 7.23).

Shared Use Paths Next to Roadways

Two-way shared use paths aligned immediately adjacent to or along a street or roadway often do not function well due to problems related to bicycle use. On a shared use two-way path, some of the bicyclists will be travelling against the normal flow of motor vehicle traffic, which is contrary to the rules of the road. See Exhibit 7.24. Bicyclists may ride so close to parked cars that they risk being hit by vehicle door openings.

Conflicts at intersections and driveways are a major concern on paths adjacent to roadways.

EXHIBIT 7.22 *A shared use path needs to be designed to minimize conflicts between pedestrians, bicyclists, and other users.*

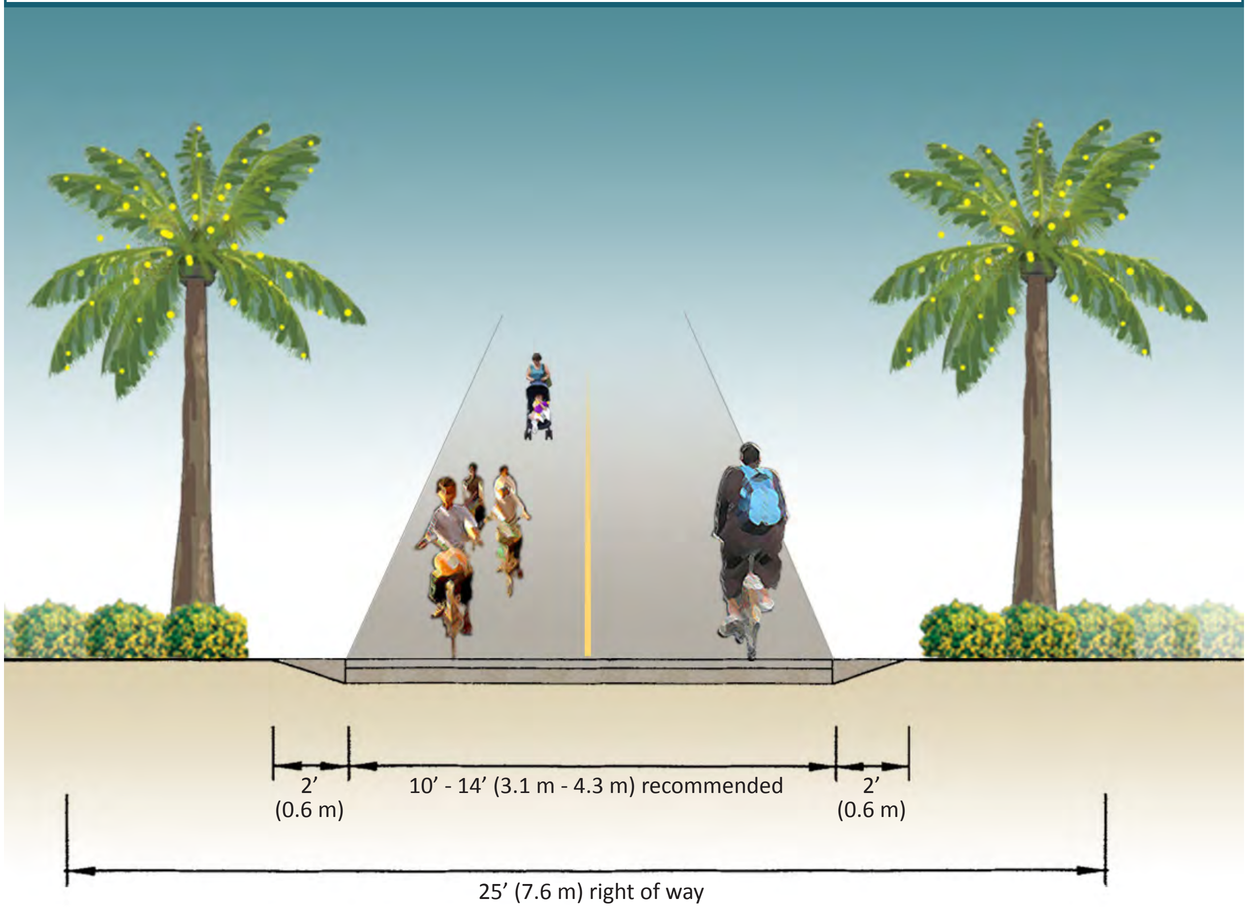


EXHIBIT 7.23 *Hard and soft surface paths can run next to each other to separate different kinds of users.*

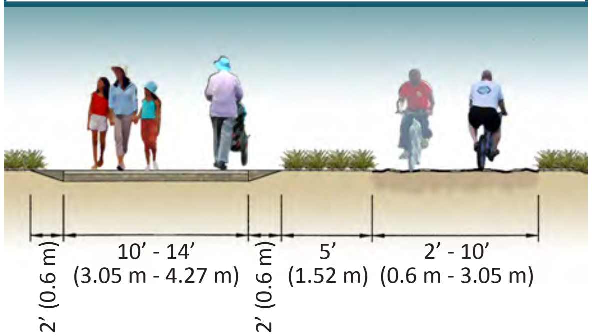
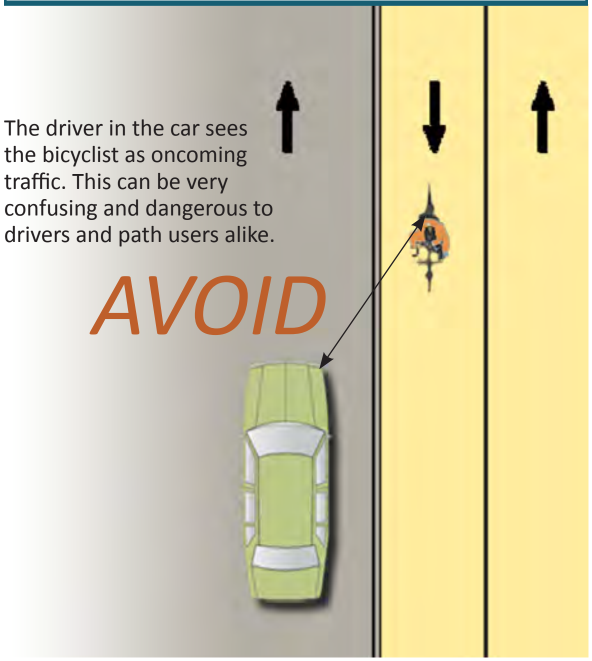


EXHIBIT 7.24 *Avoid shared use paths directly adjacent to roadways unless buffer width can be provided.*



Motorists often will not notice bicyclists coming toward them on the right, since they do not expect to see them travelling against the flow of traffic. Additional problems are listed in the AASHTO *Guide for the Development of Bicycle Facilities.*

Consider the development of a shared use pedestrian and bicycle path within the right-of-way and adjacent to a roadway only when the conditions listed in Exhibit 7.25 exist.

When there is no feasible alternative to locating a two-way shared use path within the roadway right-of-way, adequate separation of at least 5 ft (1.5 m) is required.

EXHIBIT 7.25 Conditions Where a Shared Use Path May be Acceptable Next to a Roadway

The path can be separated from motor vehicle traffic. AASHTO standards require a minimum horizontal separation of 5 ft (1.5 m) or a physical barrier.
Development of bike lanes and sidewalks as an alternative to the shared use path would not be a feasible alternative. (Bike lanes and sidewalks typically take up less space than shared use paths within the right-of-way and allow bicyclists to travel with the normal flow of traffic.) Also, as stated previously, shared use paths may not be an adequate substitute to standard pedestrian and bicycle facilities within the right-of-way.
There are no reasonable alternative alignments for bikeways and sidewalks on nearby parallel routes.
There is a commitment to provide a continuous non-motorized system throughout the corridor where potential driveway and intersection conflicts can be minimized and mitigated.
Bicycle and pedestrian use is anticipated to be high.
The path can be terminated at each end onto streets with good bicycle and pedestrian facilities, or onto another safe, well designed path.
There are popular origins and destinations throughout the corridor (schools, parks, and neighborhoods).
The path can be constructed wide enough to accommodate all types of users, with delineation and separation techniques to minimize conflicts between users — 12 ft (3.6 m) desirable, 14 ft (4.3 m) optimum.

Beach Access

Because all beaches in the state of Hawaii are public lands, special consideration needs to be given to the ways a path or trail can connect to shorelines, especially where existing resorts, shopping centers, or housing developments create barriers to public beach access.

Many beach-front properties currently include public access easements, and path and trail planners and designers will want to take this into consideration when determining the best path alignment approach to shoreline areas. In cases where land uses and development configuration point to a beach access location where no easement exists, it will be necessary to seek agreements with property owners so that new easements can be established.

Many commercial properties include perimeter paths, alley ways, service areas, or buffer planting areas that may be adopted for use to provide public path access to the beach. Dense vegetation buffers or fencing can be introduced to provide separation between the path and potentially conflicting activities or uses.

Because beach access paths have a relatively high rate of usage, special consideration should be given to enhance user comfort and safety. Beach access points offer good opportunities for constructing overlook decks for people whose disabilities limit access to sandy areas. Amenities like these need to be designed to minimize conflicts with path users.

Provide lighting in beach access areas open for night-time use. However, it may not be desirable to encourage beach use at night in all locations. Areas of active use or that receive regular patrols are best for night use.

Exhibits 7.26, 7.27, 7.28, 7.29, 7.30, 7.31, and 7.32 illustrate various recommended design solutions for beach paths and access areas. A summary of the proposed ADA guidelines for beach access is included in Exhibit 7.29.

Managing Motor Vehicle Access

As a general rule, separated paths function best when motor vehicle access is prohibited or limited to maintenance vehicles for periodic inspection, sweeping, and repairs, utility vehicles, and emergency vehicles. The following

EXHIBIT 7.26 *Beach Access at a Resort*

EXHIBIT 7.27 *Beach Access Between Two Units of Multi-Family Housing*

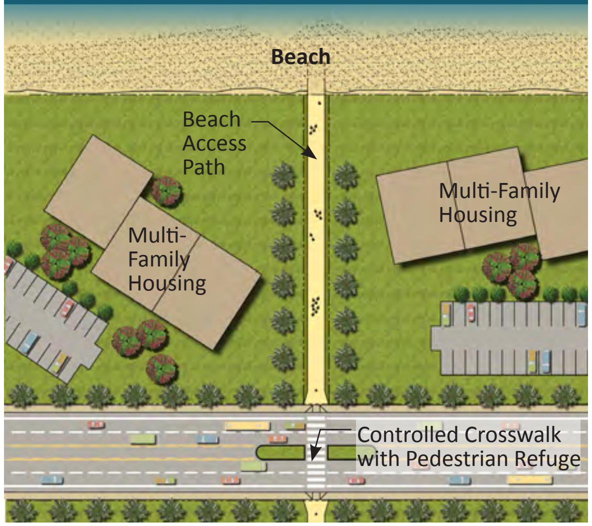


EXHIBIT 7.28 *Beach Access Between Two Single Family Homes*

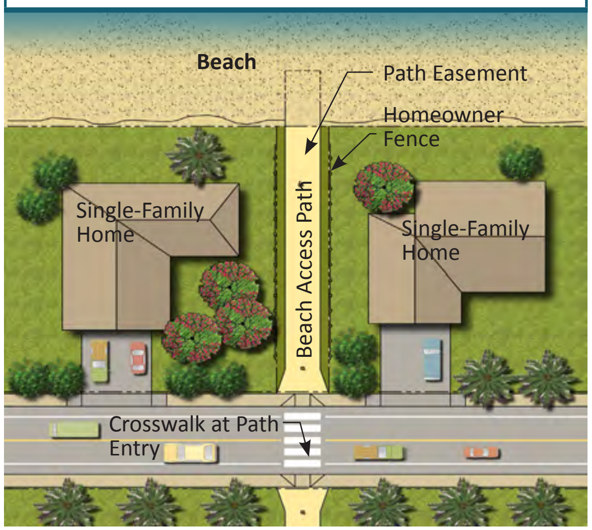
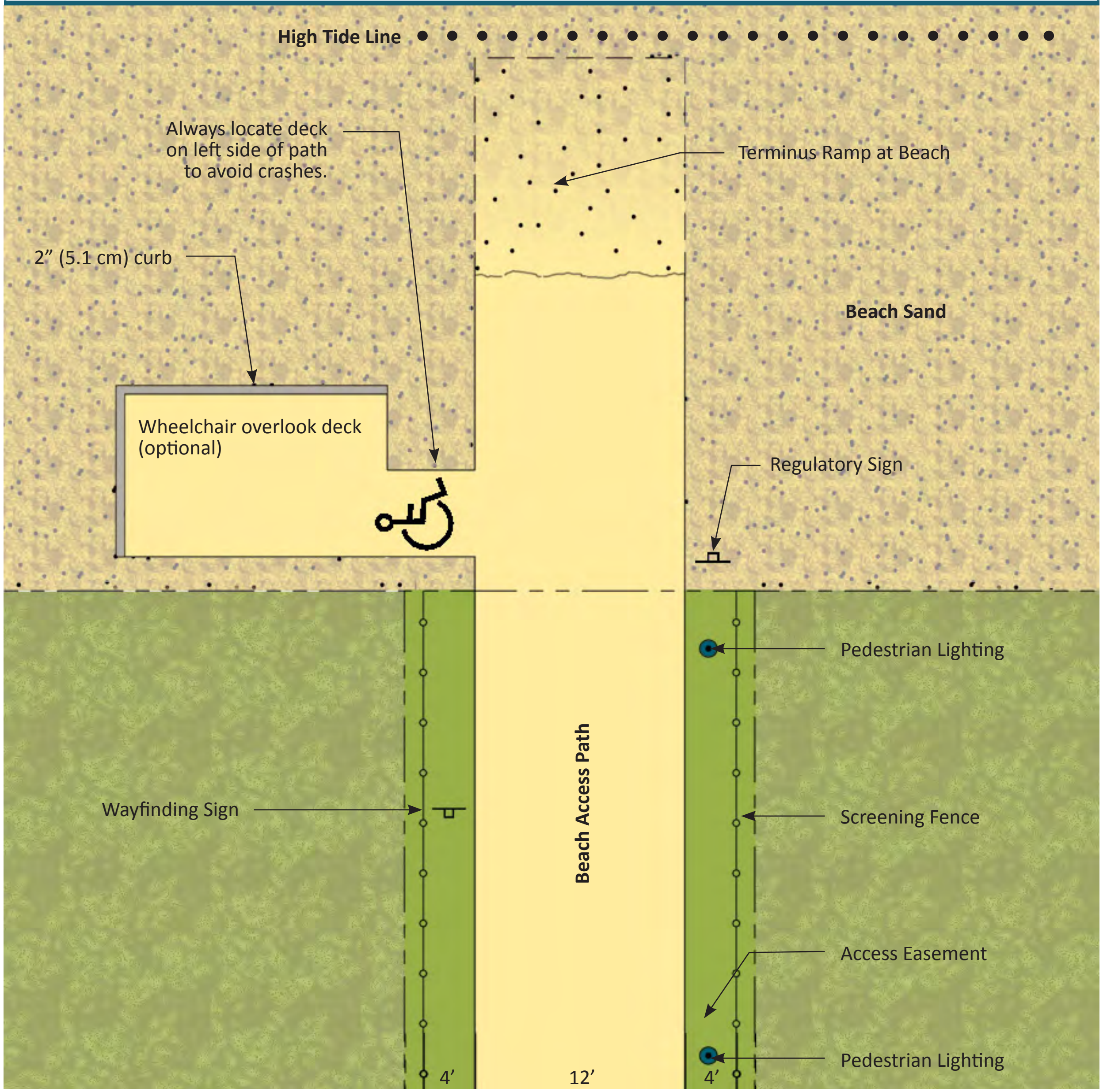


EXHIBIT 7.29 *Summary of ADA Guidelines for Beach Access*

DESIGN ELEMENT	DESCRIPTION		
Connections	Beach access routes shall connect an entry point to the beach to the high tide level at tidal beaches.		
Surface	Firm and Stable		
Width	5' (1.5 m)/60" (152.4 cm) minimum (wider with regular use of paths/higher volumes of pedestrians)		
Obstacles	Shall not exceed 1/2" (13 mm) above concrete, asphalt or board surfaces Shall not exceed 1" (25 mm) above other surfaces		
Grating or Decking Gaps/ Openings	Shall not exceed 1/2" (13 mm). Exceptions apply. See ODAAG.		
Slopes	Shall not exceed 1:10		
	For Running Slopes between 1:10 and 1:20:		
	Running Slope of Segment		Max. Length of Segment
	Steeper than	But Not Steeper Than	
	1:20	1:12	50' (15 m)*
	1:12	1:10	30' (9 m)*
	*Resting area required at end of segment.		
Cross Slopes	Shall not exceed 1:48 for concrete, asphalt or board surfaces Shall not exceed 1:33 for other surfaces		
Resting Intervals	Minimum size shall be 60" by 60" (152.4 cm by 152.4 cm)		
	Cross slope shall not exceed 1:48 in any direction for concrete, asphalt or board surfaces. Cross slope shall not exceed 1:33 in any direction for all other surfaces		
Protruding Objects	See ODAAG.		
Elevated Crossings	If elevated crossings (such as boardwalks, platforms, bridges, etc.) are part of a path or beach access route, handrails and edge protection in accordance with ODAAG shall be provided, except: • Clear width may be 48" (122 cm) minimum • Resting intervals do not need to comply with size and cross slope minimums above.		

Source: US Access Board Outdoor Developed Area Accessibility Guidelines

EXHIBIT 7.30 Typical Terminus for a High Use Beach Access Path



design treatments are suggested for managing motor vehicle access on paths:

- Pavement cross sections with sufficient base and thickness are necessary to support maintenance vehicles while minimizing deterioration. A 4 in (10.2 cm) asphalt thickness over an 8 in (20.3 cm) aggregate base is recommended.
- Trail and path edges need to be designed with added thickness to support vehicle loads. See Exhibit 7.33 for thickened-edge pavement design.
- Access points can be provided from roadways for use by maintenance and emergency vehicles, but blocked from use by other motor vehicles with removable bollards or coded gates.
- Gates or bollards at side entrances to the path can be specially designed to allow passage for pedestrians, wheelchairs, and bicyclists without providing an access point for motor vehicles.
- Signing can be installed to notify trail and path users that maintenance vehicles may

EXHIBIT 7.31 ***Beach Access Cross Section***

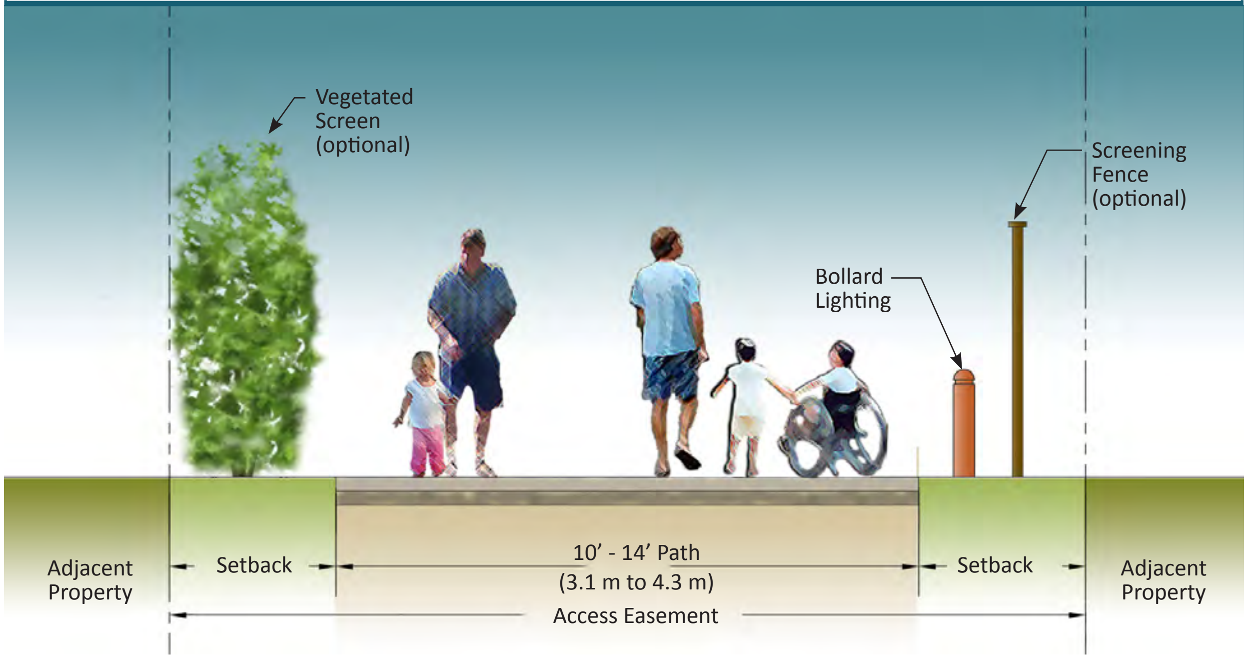


EXHIBIT 7.32 ***Path Terminus Ramp at Beach***

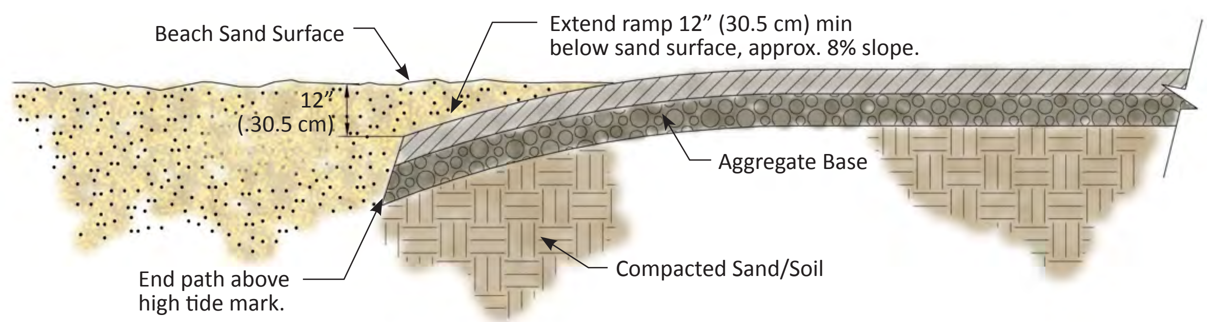


EXHIBIT 7.33 ***A thickened path edge can provide extra stength if needed.***

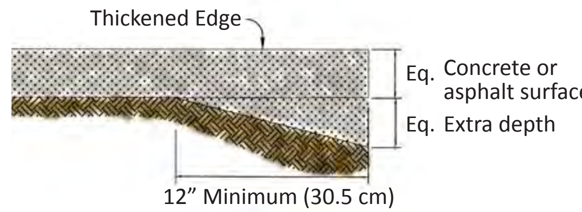
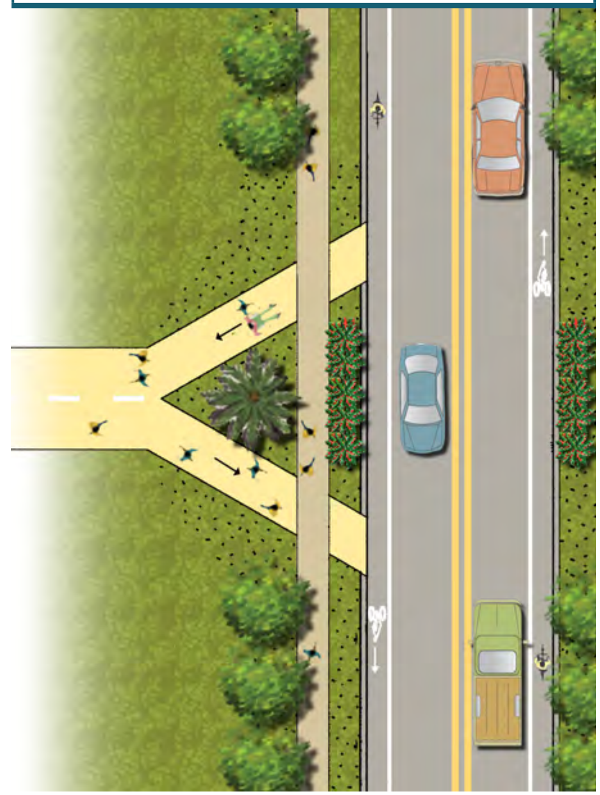


EXHIBIT 7.34 ***A split design at roadway intersection can help to deter vehicles from entering the path.***



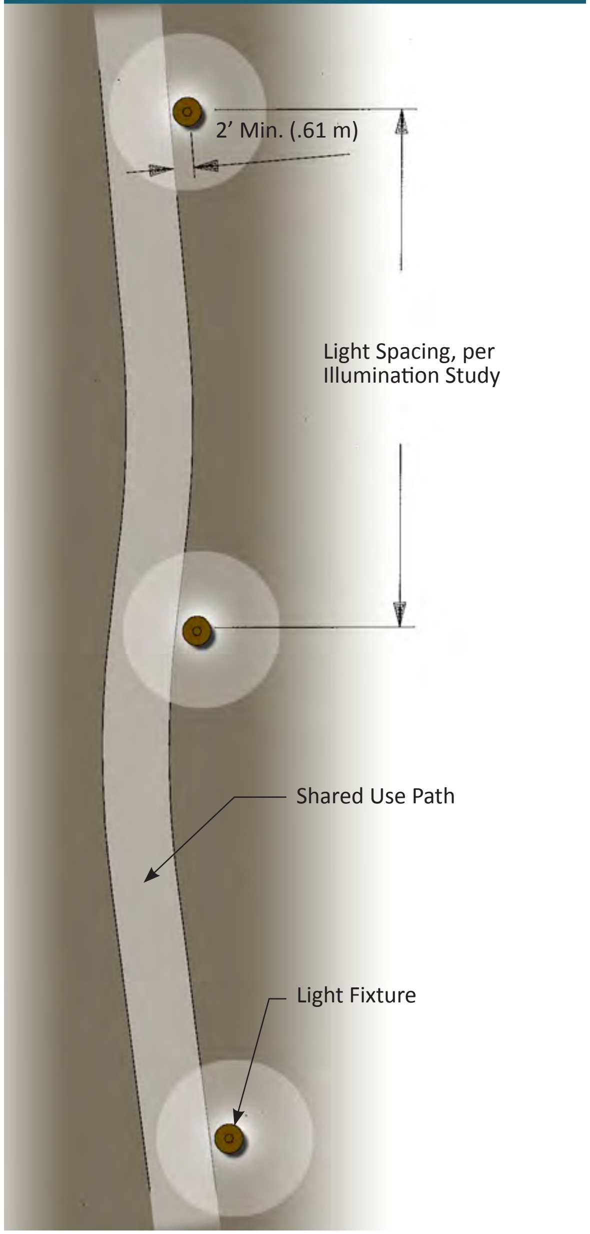
be entering the system at the identified locations. Temporary signs and markers need to be carried and placed at appropriate locations as warning devices during maintenance activities.

- Motor vehicles can be restricted from entering paths through the use of special design techniques, such as short curb radii or a split path configuration (see Exhibit 7.34 on previous page). These techniques are most appropriate at locations where maintenance and emergency vehicles do not require access to the trail.

Nighttime Use

When paths are frequently used during night-time hours, lighting is an important consideration. Lighting should be designed according to applicable local standards, with consideration toward maximizing pedestrian safety and security while minimizing glare and obtrusiveness to surrounding neighborhoods. Pedestrian-scale lighting with poles and fixtures at 12 to 15 ft (3.6 m to 4.5 m) and bollard lights are options that work well on shared use paths. Lighting may not be appropriate in more remote areas because it can inadvertently attract users to areas that may not be secure. Lighting design should comply with any applicable dark sky conservation, energy conservation, or other local lighting regulations.

EXHIBIT 7.35 Path Lighting



Illumination levels are measured in footcandles (lumens per foot). Depending on the location, average maintained horizontal illumination levels of 0.5 to 2 footcandles (5 to 22 lux) should be considered for pedestrian and bicycle use areas. Within undercrossings and near building entrances and other locations, higher lighting levels may be needed.

The use of 4 to 6 in (10.2 to 15.2 cm) wide white edge lines may be beneficial on paths where nighttime use is not prohibited to better define the edges of the path. See Exhibit 7.35.

Maintenance

Several suggestions have been provided throughout this section related to maintenance. It is important to establish a maintenance program at the time a project is developed to ensure that the path will function properly over the long term. Maintenance activities should be scheduled during times of typically low path use, if possible. Proper work zone signing should be used when maintenance occurs on or adjacent to pedestrian travel ways. Refer to Toolbox Section 11 for additional guidance.

Interpretive and Learning Opportunities Along Paths and Trails

Path and trail users' experiences can be enhanced by introducing opportunities for interpretation and learning. School districts, cities, natural resource advocates, and other groups may want to consider developing an interpretive program for path and trail segments near points of interest in the natural environment. Programs can be geared to raise the awareness about topics such as sensitive ecologies, cultural resources and history, geologic processes, conservation, and environmental stewardship. The interpretive program can include plant and wildlife identifiers, bird blinds, colorful displays depicting native flora/ fauna/ habitat, historical/cultural information, or stations keyed to printed handouts with more in-depth descriptions of unique site characteristics. The types of amenities selected should respond to site-specific opportunities for interpretation and learning. New technologies such as GPS coordinate references and information alerting visitors to podcast availability on certain subjects are becoming more common in destinations such as national parks, wildlife refuges, and other visitor areas.

All signs and interpretive displays need to be located outside the lateral clearance areas along paths and trails. They should also be designed to require minimal maintenance. Design should maximize durability and vandal proofing. For example, placing these features in high use, public areas will minimize graffiti activity and the use of certain materials will enhance clean up and replaceability.

Other Resources

The following sources of information are recommended for design of shared use paths and recreational trails.

- American Association of State Highway and Transportation Officials (AASHTO). *A Policy on the Geometric Design of Highways and Streets, 5th Edition.* 2004.

Providing information and interpretation along paths enhances the experience for pedestrians and bicyclists.

- American Association of State Highway and Transportation Officials (AASHTO). *A Guide for Achieving Flexibility in Highway Design.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for Development of Bicycle Facilities, 4th Edition.* 2012.
- American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Planning, Design and Operation of Pedestrian Facilities.* 2004.
- American Association of State Highway and Transportation Officials (AASHTO). *Roadside Design Guide.* 2002.
- American Planning Association, Wiley & Sons, Inc. publishers. *Planning and Urban Design Standards.* 2006.
- City of Bellevue, Washington. Tr*ansportation Design Manual.* 2012. Website: ***http://www.bellevuewa.gov/pdf/Transportation/Transportation_Design_Manual.pdf*** (May 2013).
- City and County of Honolulu, Department of Transportation Services. *Oahu Bike Plan.* (Supersedes the previous Honolulu Bicycle Master Plan). Website: ***http://www1.honolulu.gov/dts/oahu+bike+plan.htm*** (May 2013).
- Federal Highway Administration. DRAFT Accessibility Guidelines for Bicycle and Pedestrian Facilities. Recreational Trails and Transportation Enhancement Activities. October 2008. Website: ***http://www.fhwa.dot.gov/environment/recreational_trails/guidance/accessibility_guidance/guidance_accessibility.cfm*** (May 2013).
- Federal Highway Administration. Kirschbaum, J.B., Axelson, P.W., Longmuir, P.E., Mispagel, K.M., Stein, J.A., and Yamada, D.A. *Designing Sidewalks and Trails for Access, Parts I and II.* 1999.
- Federal Highway Administration. Landis, B.W, Petrisch, T.A., and Huang, H.E. Characteristics of Emerging Road and Trail Users and Their Safety. 2004.
- Federal Highway Administration. *Manual on Uniform Traffic Control Devices.* 2009.
- Federal Highway Administration. *Shared Use Path Level of Service—A User's Guide and Shared Use Level of Service Calculator.* 2006. Website: ***http://www.fhwa.dot.gov/publications/research/safety/pedbike/05138/index.cfm*** (May 2013).
- Federal Highway Administration. Zegeer, C.V., J.R. Stewart, Huang, H.H., Lagerwey, P.A., Feaganes, J, and Campbell, B.J. *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines.* 2005.
- Florida, State of. *Florida Pedestrian Planning and Design Handbook.*
- Harris, Charles W. and Dines, Nicholas T. *Timesaver Standards for Landscape Architecture, Design and Construction Data.*
- Hawaii Department of Transportation. *Bike Plan Hawaii.* Website: ***http://www.hawaii.gov/dot/highways/Bike/bikeplan/index.htm#bikeplan*** (May 2013).
- Hawaii State Legislative Report. *Hawaii Complete Streets Policy.* Website: ***http://www.Hawaii.gov/dot/administration/library/2011*** (May 2013).

- National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide. 2011.
- National Complete Streets Coalition. Website: ***www.completestreets.org*** (May 2013).
- Nelischer, Maurice. *Handbook of Landscape Architectural Construction, Volume Two, Site Works.*
- Oregon, State of, Department of Transportation, Bicycle and Pedestrian Program. *Oregon Bicycle and Pedestrian Plan—An Element of the Oregon Transportation Plan.*
- PLAE, Inc. *Universal Access to Outdoor Recreation: A Design Guide.*
- Rails to Trails Conservancy. Website: ***http://www.railstotrails.org/index.html*** (May 2013).
- Rails to Trails Conservancy. Flink, Charles, Olka, Kristine, and Seams, Robert. *Trails for the Twenty-First Century—Planning, Design, and Management Manual for Multi-Use Trails.* 2001.
- United States Access Board. *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way.* 2011. Website: ***http://www.access-board.gov/*** (May 2013).
- United States Access Board. Recreation Access Advisory Committee. *Recommendations for Outdoor Developed Areas Accessibility Guidelines (ODAAG), Final Draft.* 2009. Website: ***http://www.access-board.gov/*** (May 2013).
- United States Access Board. *Shared Use Path Accessibility Guidelines (SUPAG), ANPRM,* and *Architectural Barriers Act Accessibility Guidelines for Shared Use Paths.* 2011. Website: ***http://www.access-board.gov/*** (May 2013).
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- Van Houten, R. *The Effects of Advance Stop Lines and Sign Prompts on Pedestrian Safety in Crosswalk on Multilane Highway.* Journal of Applied Behavior Analysis, Vol. 21. 1988.
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STOP

TOOLBOX SECTION

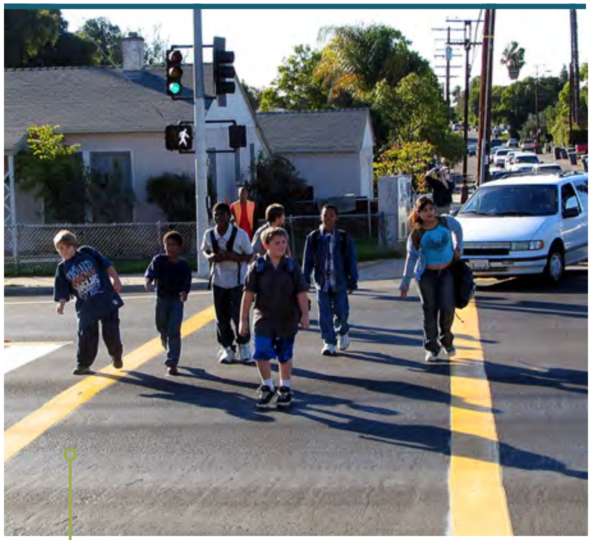
8

Children and School Zones

A very high priority should be placed on children's safety while walking to school.

CHILDREN AND SCHOOL ZONES

Walking to school is a memory that many people cherish, yet there has been a radical drop in the number of children doing this over the past few decades. At the same time, there has been a dramatic increase in health problems in children due to lack of physical fitness. The prevalence of childhood obesity and diabetes has risen to an all time high in the United States within the last decade. Walking to school can provide many benefits.



Children at a crossing
(Dan Burden, PBIC)

For example, walking to school:

- Serves as a transportation mode to and from the school site
- Can be fun
- Provides opportunities for daily exercise
- Connects children with their neighborhood and the natural world
- Teaches children independence and the responsibility that comes with it
- Reduces traffic congestion and environmental impacts

Physical improvements and educational programs are often needed to encourage and aid walking to school. Improvements to school walk routes can improve walkability of neighborhoods in general.

A very high priority should be placed on children's safety while walking to school. When a collision occurs between a moving vehicle and child, the consequences are often severe and tragic. Because of this, communities work very hard to promote student pedestrian

IN THIS SECTION

A study by the US Centers for Disease Control found that long distances and dangerous motor vehicle traffic were the most common major barriers to students walking or biking to school.

EXHIBIT 8.1 Some Special Limitations of Children Aged 5 to 9

Because children are shorter than adults—their typical eye height is 3 ft (0.9 m) above ground, their field of vision is different.
Children have one-third narrower side vision than adults and are less able to determine the direction of sounds.
Children have trouble judging speeds and distances of moving cars.
Children are sometimes too small to be seen by fast moving or inattentive drivers.
Children move less predictably than adults.
Children have shorter attention spans and may grow impatient at crossings.
Children have less experience as pedestrians and may not be fully aware of dangerous conditions.
Children lack the understanding of drivers' intentions at intersections, crossings, or drop-off points, since they don't drive.

Source: Washington State Pedestrian Design Guidelines

safety. There are well known processes and techniques for promoting student pedestrian safety, and this toolbox section explains many of them.

Special Considerations Related to Children

It is important to remember the special limitations of children when designing for them. Children are more vulnerable to collisions than adults both physically and developmentally. Exhibit 8.1 lists the special limitations of children aged five to nine that need to be considered when walking routes to and around schools.

In addition to children's inherent vulnerability to traffic, research has shown that adults tend to overestimate a child's capabilities to deal with traffic, particularly when crossing the street. Adults sometimes fail to realize that many children under age nine lack the developmental skills to safely and consistently cope with moving traffic. Clearly both students and adults need to be educated about student pedestrian safety.

Improving Student Pedestrian Safety—a Cooperative Process

The safety of student pedestrians requires a coordinated effort from all stakeholders: parents, teachers, schools and school districts, public works departments, transportation departments, law enforcement, neighborhood groups, and the general community. All stakeholders must work together to identify problems and implement improvements. For example, on Oahu, there is a committee that meets once a month to discuss potential traffic safety concerns for students. Public agencies can also work with private developers to design neighborhoods with student pedestrian safety in mind.

Younger children are particularly vulnerable to collisions. In the ten-year-period between 1998 and 2008, nearly one-half of all school-age pedestrians killed in school transportation-related crashes were between the ages of 5 and 7 in the United States.

Source: National Highway Traffic Safety Administration, National Center for Statistics and Analysis

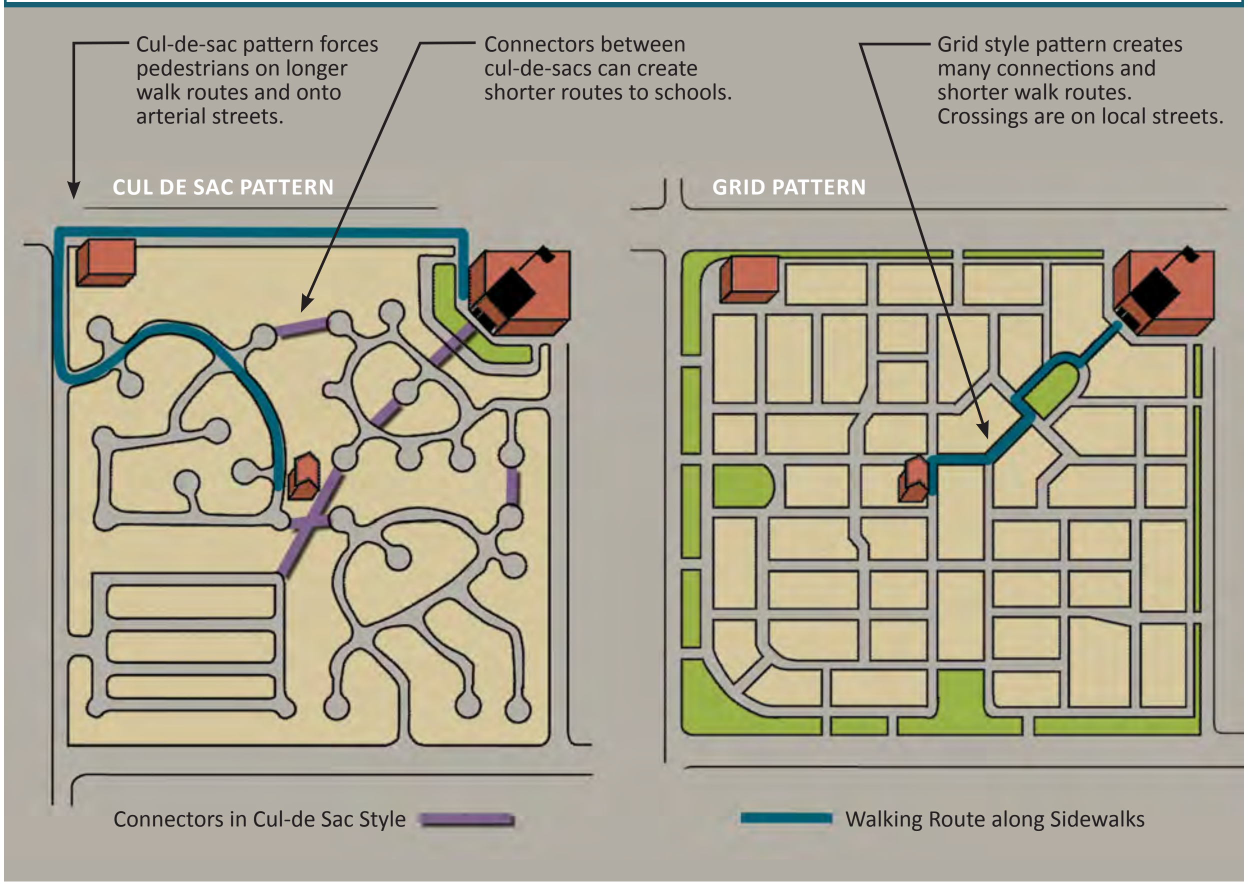
Schools as Community Focal Points

Schools are often focal points in the community, serving as places of education and also providing spaces for meeting, voting, and other community services, as well as outdoor fields and facilities for play and recreation. These multiple functions will naturally draw diverse

Parents play an important role in student pedestrian safety (Aiea High School Website)

It is important to remember the special limitations of children when designing for them.

EXHIBIT 8.2 ***Neighborhood street patterns can affect walking distances and safety.***
(Adapted from the National Center for Safe Routes to School website information, www.saferoutesinfo.org)



elements of the community together. In turn, the community can benefit from improvements to student pedestrian safety because these improvements enhance the walkability of the neighborhood in general.

Location of New Schools in Neighborhood Design

When master planning new communities, schools should be located within walking distance of all proposed neighborhoods and residential areas. Schools should be centered within the community since they often provide important community services (meeting rooms, playgrounds, gyms, etc.) Schools also should be located where major street crossings are minimized. Elementary and middle schools should be located in residential neighborhoods on local streets. This prevents young children from having to cross an arterial street to get to their school. It may be preferable to refurbish an older school that is already in a residential neighborhood than to build a new school. In Hawaii, no school should be located directly on state highways. When designing enrollment boundaries, consideration should be given to crossings; boundaries should be drawn to avoid difficult crossings for young children.

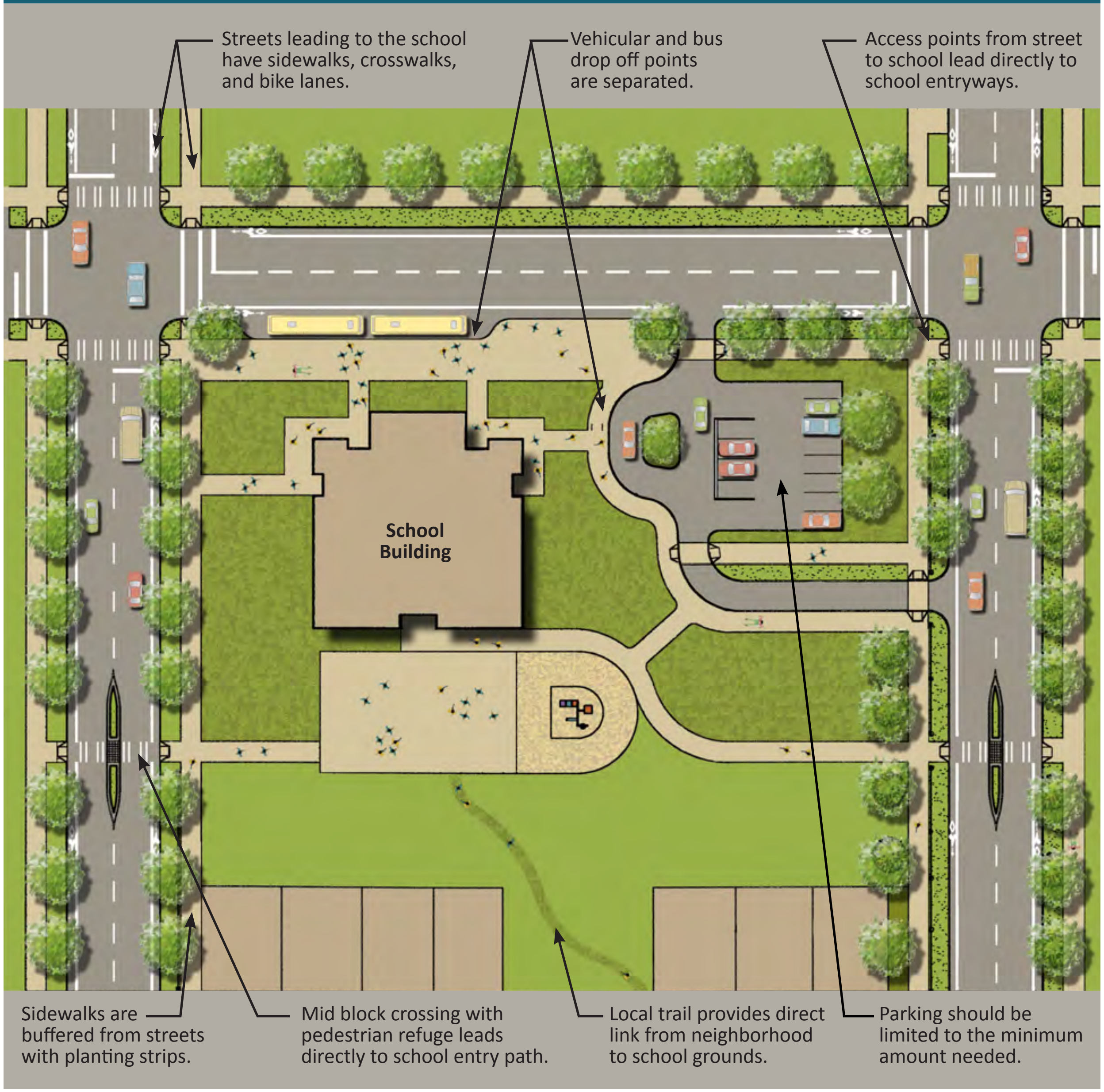
Neighborhood design itself also influences student pedestrian safety. Grid-style street patterns increase connectivity and can result in short walking distances to schools. Crossings are kept to local streets. Curvilinear and cul-de-sac style neighborhoods tend to channel pedestrians out to the more dangerous arterial streets, which lengthens walking distances. Cut throughs from cul-de-sac to cul-de-sac can reduce this problem. See Exhibit 8.2.

Design Considerations in Areas Surrounding Schools

Considerations of the needs of students walking to school should be integral to the design of streets and shared use paths located within walking distance of schools.

School sites should be accessible to pedestrians from all sides. Streets leading to the school site should be designed to include full sidewalk or walkway improvements and other elements that contribute to pedestrian safety and comfort. Intersections and crossings within the vicinity of the school need to be well designed, with a focus on the needs of student pedestrians. (See "Traffic Control and Crossing," later in this toolbox section.) It is equally important to consider how bicycle access to schools can be improved, as many students travel by bike. Exhibit 8.3 shows typical elements on and adjacent to school sites that function well for pedestrians and encourage pedestrian travel. Exhibit 8.4 illustrates design solutions for a school site in a suburban or rural area. Exhibit 8.5 lists best practices for design near schools.

EXHIBIT 8.3 A Well Designed School Site in an Urban Area



Sidewalks and Walkways

Sidewalks and walkways should be provided in all areas surrounding the school and on the school site. Vertical separation (curbs) and horizontal separation (planting buffers, ditches, or swales) from motor vehicle traffic should be installed to separate student pedestrians from traffic. Wider sidewalks at the school will accommodate a greater number of students as they approach the school.

On roads without sidewalks, widened shoulders accommodate pedestrians. Shoulders may be paved or unpaved, but if unpaved, a well compacted, firm, stable, and slip resistant surface of crushed rock or other material is required. Shoulders that are part of a designated school walk route should be minimum 5 ft (1.5 m) wide, 8 ft (2.4 m) preferred, and should be provided on both sides. If a shoulder can only be provided on one side, provide a minimum of 8 ft (2.4 m) in width to allow students to walk off the roadway in either direction. Although this is not the most desirable solution (shoulder on only one side), it is better than having no pedestrian travel areas at the roadside.

EXHIBIT 8.4 A School Site in a Suburban or Rural Location with Well-designed Pedestrian Facilities for Students

1. Continuous sidewalks along driveway and adjacent streets
2. Separate bus and car entries
3. Well marked walkways and crosswalks
4. Separate car and bus drop off areas
5. Common entry for all students
6. Connection to local trail system

EXHIBIT 8.5 Best Design Practices Near Schools

Surrounding and adjacent streets should provide sidewalks and bike lanes.
School buildings should be accessible to pedestrians from all sides (or at least, from all sides with entries/exits).
Paths and trails should provide direct links between the school site and the surrounding neighborhoods.
Buses, cars, bicycles, and pedestrians should be separated and provided with their own designated travel routes.
Bus and auto drop-off zones should be separated to minimize confusion and conflicts.
Pedestrian travel zones (sidewalks, etc.) should be clearly delineated from other modes of traffic (through the use of striping, colored and/or textured pavement, signing, and other methods).
Parking should be minimized; people should be encouraged to walk to school.
Pedestrians should be clearly directed to crossing points and pedestrian access ways by directional signing, fencing, bollards or other elements.
Strategically located, well-delineated crossing opportunities should be provided, including marked crosswalks at controlled intersections and mid-block crossings (signalized if warranted).
Traffic calming devices (raised crossings, refuge islands, bulb-outs at crossings, on-street parking, traffic circles, landscaping, etc.) should be installed in the vicinity to slow vehicles.
View obstructions should be avoided so there is clear visibility of pedestrians throughout the area.
Parking restrictions should be required in areas close to children walk routes.
Student crossings and bus loading zones should be adequately lit.

Students safely cross the street while holding hands.

Middle school students walking home from school in Hawaii.

School Bus Stop Design

Bus stops must provide sufficient waiting area away from the roadway for the number of children using the stop. Exhibits 8.6 and 8.7 illustrate two typical designs for school bus stops —one for streets with sidewalks and one for areas where widened shoulders function as the pedestrian travel zone.

Visibility at Crossings and Along School Walk Routes

Since children are smaller than adults and more difficult for motorists to see, special attention should be paid to providing an unobstructed visual field between motorists and school children. Street furniture, utility poles, mailboxes, and other obstructions should not hide the pedestrian from view. Low growing plants and shrubs, with a maximum height of 2 ft (0.6 m), that won't block views of pedestrian should be selected. Trees along streets should be upward branching, with lower branches pruned to 8 ft (2.4 m) above ground.

Student Drop-Off and Pick-Up Zones

Student drop-off and pick-up zones can create hazardous situations for children because of congestion and driver inattention or distraction. These zones should be clearly marked, separated from the bus drop-off zone, and located away from school crossings. Adequate queuing space on the school site needs to be identified. Further, parents should be informed well in advance of the location and guidelines for using these zones. This gets them started off with the best behavior.

Drop-off and pick-up zones should be located on school sites and not on streets or roadways in the vicinity of schools. Parking also should be restricted around schools and at school crossings. Recommended setbacks for parked vehicles near school crossings is 100 feet. Refer to Toolbox Section 2—Pedestrian-Friendly Streets for more information.

EXHIBIT 8.6 *Typical Bus Stop Design for Urban Location with Sidewalks*

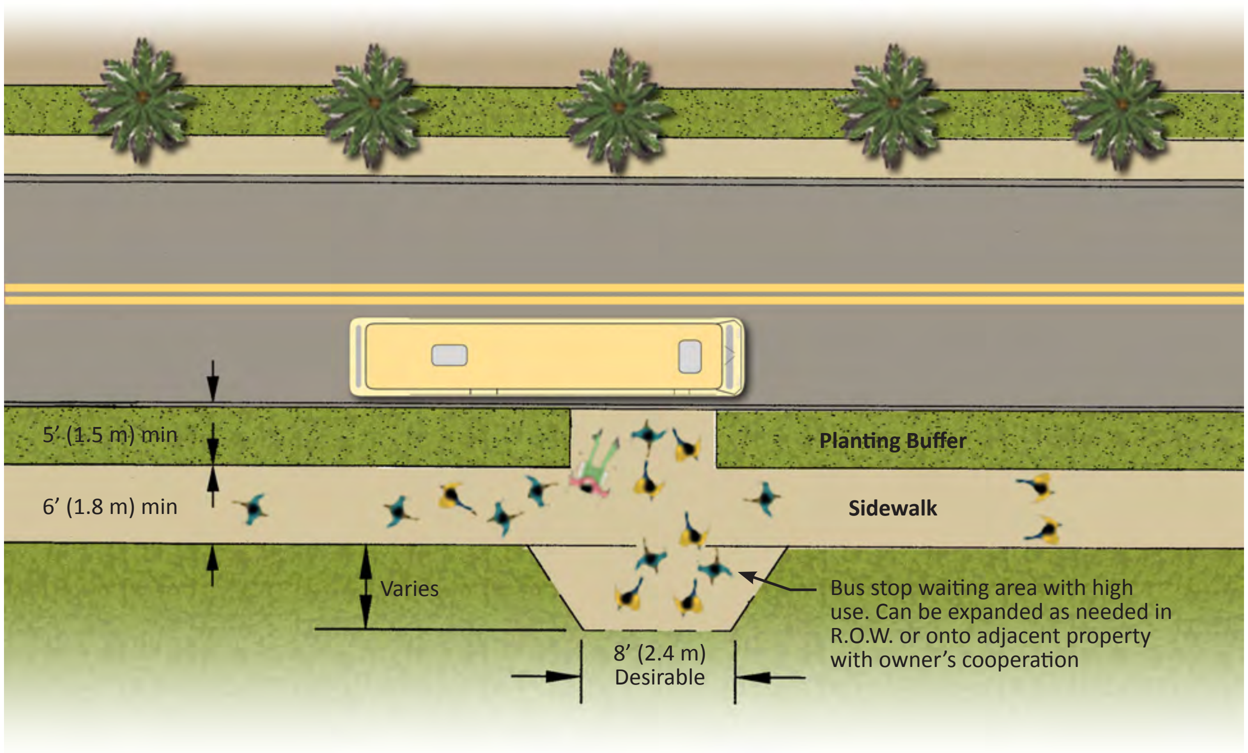


EXHIBIT 8.7 *Typical Bus Stop Design for Rural Location*

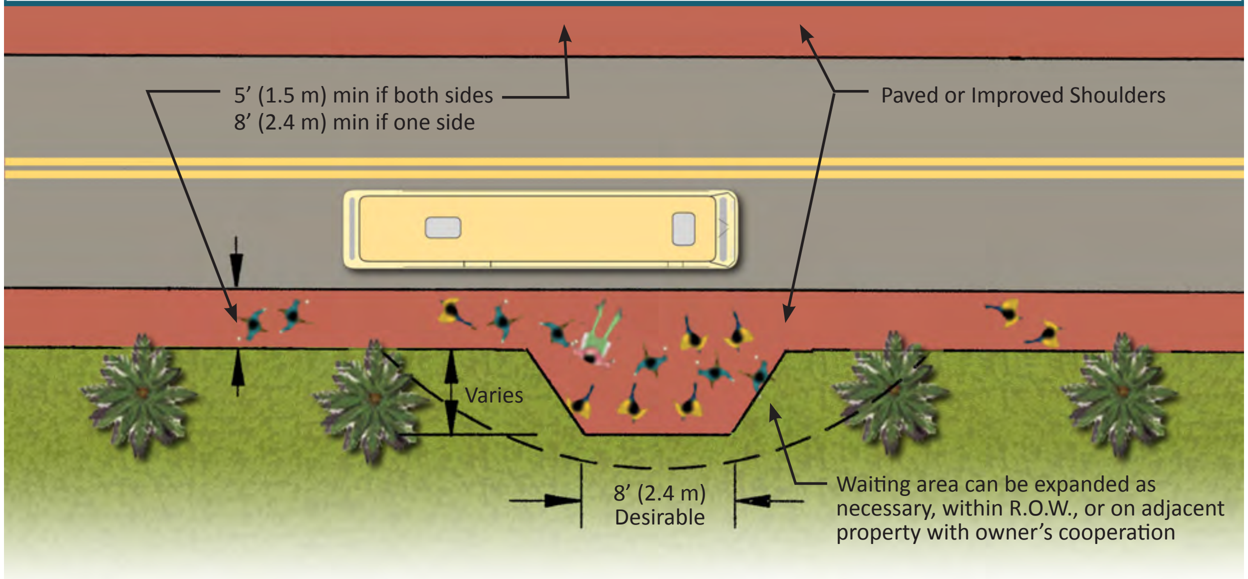


EXHIBIT 8.8 *Hawaii's Safe Routes to School Hui*

EXHIBIT 8.9 *Procedures for Developing School Walk Routes*

1. Form Safety Advisory Committee (SAC).
2. Prepare base maps.
3. Inventory existing walking conditions.
4. Inventory traffic characteristics.
5. Design the walk routes.
6. Prepare the draft walk route maps.
7. Review the route maps with the SAC.
8. Have route maps approved by the school board.
9. Distribute and explain the maps.
10. Evaluate the program.

Safe Routes to Schools

One of the most important tools communities can harness to improve student pedestrian safety is a "Safe Routes to School" program. The three primary purposes of providing a Safe Routes to School program are to:

1. Enable children to walk/bike to school.
2. Make bicycling and walking to school a safer and more appealing transportation alternative, thereby encouraging a healthy and active lifestyle from an early age.
3. Facilitate planning and implementation of projects that will improve safety, reduce traffic and fuel consumption, and air pollution in the vicinity (approximately 2 miles) of primary and middle schools (grades K-8).

The program should address both infrastructure projects (improvement of physical facilities along school routes), and educational programs. The development of a Safe Routes to School program requires a coordinated effort by all the stakeholders in a school district, including parents, teachers, schools, neighborhood residents, public works departments, law enforcement, and the general community. The Safe Routes to School National Partnership shares best practices, helps secure funding, and provides educational materials for Safe Routes to School programs including activities in Hawaii (see Exhibit 8.8). See Toolbox Section 10—Effective Pedestrian Programs for further information on Safe Routes to School program activities in Hawaii.

It is important to note that the current federal transportation authorization, Moving Ahead for Progress in the 21st Century (MAP 21), includes a new Transportation Alternatives Program (TAP) that establishes funding for a variety of programs including Safe Routes to School. TAP administers funding for Safe Routes to School activities through state departments of transportation. Non-profits are no longer eligible to receive Safe Routes to Schools funding to implement projects under TAP.

School Walk Routes

Basic procedures for developing school walking and bicycle routes are listed in Exhibit 8.9.

EXHIBIT 8.10 ***Inventories like this one can help raise awareness of student pedestrian safety and define safe walking routes to schools.*** *(National Center for Safe Routes to School Walkability Checklist)*

Take a walk and use this checklist to rate your neighborhood's walkability.

How walkable is your community?

Location of walk

Rating Scale: 1 awful, 2 many problems, 3 some problems, 4 good, 5 very good, 6 excellent

1. Did you have room to walk?

☐ Yes ☐ Some problems:
- ☐ Sidewalks or paths started and stopped
- ☐ Sidewalks were broken or cracked
- ☐ Sidewalks were blocked with poles, signs,shrubbery, dumpsters, etc.
- ☐ No sidewalks, paths, or shoulders
- ☐ Too much traffic
- ☐ Something else ______

Rating: (circle one) 1 2 3 4 5 6 Locations of problems: ______

2. Was it easy to cross streets?

☐ Yes ☐ Some problems:
- ☐ Road was too wide
- ☐ Traffic signals made us wait too long or did not give us enough time to cross
- ☐ Needed striped crosswalks or traffic signals
- ☐ Parked cars blocked our view of traffic
- ☐ Trees or plants blocked our view of traffic
- ☐ Needed curb ramps or ramps needed repair
- Something else ______

Rating: (circle one) 1 2 3 4 5 6 Locations of problems: ______

3. Did drivers behave well?

☐ Yes ☐ Some problems: Drivers ...
- ☐ Backed out of driveways without looking
- ☐ Did not yield to people crossing the street
- ☐ Turned into people crossing the street
- ☐ Drove too fastp
- ☐ Sped up to make it through traffic lights or drove through traffic lights?
- ☐ Something else ______

Rating: (circle one) 1 2 3 4 5 6 Locations of problems: ______

4. Was it easy to follow safety rules? Could you and your child...

- ☐ Yes ☐ No Cross at crosswalks or where you could see and be seen by drivers?
- ☐ Yes ☐ No Stop and look left, right and then left again before crossing streets?
- ☐ Yes ☐ No Walk on sidewalks or shoulders facing traffic where there were no sidewalks?
- ☐ Yes ☐ No Cross with the light?

Rating: (circle one) 1 2 3 4 5 6 Locations of problems: ______

5. Was your walk pleasant?

☐ Yes ☐ Some problems:
- ☐ Needed more grass, flowers, or trees
- ☐ Scary dogs
- ☐ Scary people
- ☐ Not well lighted
- ☐ Dirty, lots of litter or trash
- ☐ Dirty air due to automobile exhaust
- ☐ Something else ______

Rating: (circle one) 1 2 3 4 5 6 Locations of problems: ______

How does your neighborhood stack up? Add up your ratings and decide.

1. ______
2. ______
3. ______
4. ______
5. ______

Total: ______

- **26–30** Celebrate! You have a great neighborhood for walking.
- **21–25** Celebrate a little. Your neighborhood is pretty good.
- **16–20** Okay, but it needs work.
- **11–15** It needs lots of work. You deserve better than that.
- **5–10** It's a disaster for walking!

Now that you've identified the problems, go to the next page to find out how to fix them.

EXHIBIT 8.11 *A School Walk Routes Map*
(Adapted from MUTCD Figure 7A-1)

CASE STUDY

SABIN ELEMENTARY SCHOOL, PART I

People who use the school and live in the neighborhood often know more about the traffic and safety issues than professionals alone. This case study from Portland, Oregon shows that parents' and neighbors' contributions can be substantial and their participation should be strongly encouraged:

"In 1997, the Portland Traffic Calming Program (TCP) undertook a School Safety Project on the streets adjacent to Sabin Elementary School to improve student pedestrian safety. After initial discussions with the school staff, parents, and neighborhood residents, it became clear that those using the school every day had identified additional traffic safety hazards that TCP assessment had not identified, including school-related bus and auto traffic congestion directly in front of the school and on its surrounding streets. Another concern was parking problems, such as the screening of kids crossing the street to/from school by parents parking in no-parking zones to drop-off, or pick-up, their own children."

(Italics added. Case Study #38 from walkinginfo.org)

A coalition of over 20 state, federal, non-profit, and private agencies have worked together to advance the Safe Routes to School program and promote healthy community design in the State of Hawaii. Exhibit 8.10 provides an example of a school walkability checklist that communities and school districts can use as a tool to define needs around schools.

The process of making school route maps raises awareness of safety issues, garners support for the proposed improvements, identifies specific traffic and safety issues, and gathers information on the best routes. Once the school walk route has been established, pedestrian safety deficiencies along the walk route can be identified. Remedial actions can then be considered and implemented as funding becomes available. Inexpensive options such as painted markings and signs should be implemented first while funding is being sought for more expensive improvements like new crossings or signals. See below for information on traffic control measures in school zones. (Refer to Exhibit 8.11 for an example of a school walk routes map.)

Traffic Control and Crossings Near Schools

Traffic control related to schools is a sensitive subject. The methods used to protect children as they walk to school need to be carefully considered and analyzed by traffic engineering professionals (including state and county traffic engineers) on a case-by-case basis before solutions are implemented. They should also be reviewed by a Safety Advisory Committee established by the school district.

Overuse of traffic control measures or implementation of nonuniform procedures and devices can cause confusion, lead to crashes, produce unnecessary costs, and lessen the respect for traffic controls that are warranted.

Traffic control and safety measures near schools include sidewalks and walkways, marked crosswalks, special school signs and markings, speed limit reduction, traffic calming techniques, and signalization, including flashing beacons. Exhibit 8.12 lists traffic control considerations for school zones.

Sidewalks and walkways are discussed above in the section on School Site Design. They should be an integral part of all new school projects.

EXHIBIT 8.12 Determining Crossing Treatments and Traffic Control in School Zones

According to the ITE's School Trip Safety Program Guidelines, the following elements are normally considered when determining appropriate traffic control measures:

- Existing and potential traffic volumes and speeds
- Inventory of existing traffic control devices and roadway facilities
- Adequacy of gaps in the stream of traffic
- Numbers and ages of children crossing (pedestrian volumes and characteristics)
- Adequacy of sight distance
- Collision statistics
- Location of the school and relationship to surrounding land uses (both existing and planned)

All crosswalks on designated school routes should be marked. Note that on streets with an Average Daily Traffic (ADT) volume of 12,000 trips or above, crosswalk markings must be combined with other safety measures (Safety Effects of Marked versus Unmarked Crosswalks at Uncontrolled Locations, FHWA, 2005). See the section on Crosswalk Markings in Toolbox Section 5.

EXHIBIT 8.13 School Related Signs

Options:

School Area and School Zone Sign (S1-1): This sign can be used to warn motorists that they are approaching a school area. It must be used to identify the location of the beginning of a state-designated school zone. It can be combined with "ALL YEAR" or "SCHOOL" plaques, or pointer arrows if the school zone is near an intersections.

Options:

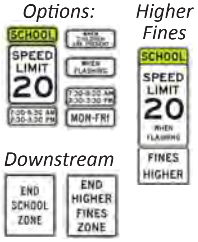
School Advance Crossing Assembly: This sign combines the School Sign with an "AHEAD" or "XX FEET" plaque to warn motorists of an upcoming school crossing. It must be used in advance of school crosswalks. MUTCD Table 2C-4 gives guidelines for how far in advance of the school crossing to place this assembly. It may be omitted if a School Zone sign is placed in advance of the crosswalk.

School Crossing Assembly: This sign combines the School Sign with a diagonally pointing downward arrow, and must be used at school crossings. It may not be used for crossings other than those adjacent to schools or on established school pedestrian routes. Also, it may not be used on approaches controlled by a Stop or Yield sign.

School Bus Stop Ahead: This sign is intended for use in advance of locations where a school bus stop is not visible for an adequate distance. It is not intended for these signs to be placed everywhere a school bus stops, but only in locations where terrain or other features limit sight distance and there is no opportunity to relocate the stop to a more visible location.

Options: Higher Fines

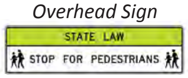
Downstream



School Speed Limit and Fines Signs: These signs must be used to indicate the speed limit within designated school zones if a traffic engineering study recommends it or state statute (*see below) requires it. School Speed Limit Signs may be accompanied by signs that indicate applicable hours or conditions of speed limit reduction (e.g. "when children present"). If higher fines for traffic violations are in effect, the applicable Fine signs must also be installed. The downstream end of the school speed limit or higher fines zones must also be identified. See the MUTCD Section 7B.15 for more information.

In Street Signs

Overhead Sign



In-Street and Overhead Crossing Signs: These signs may be used to provide additional warning to motorists about the presence of school children. Seasonal use of in-street signs can provide an additional safety measure at the beginning of the school year, when it is particularly important for motorists to be attentive to the presence of student pedestrians. These signs may be used instead of or in combination with the School Crossing Assembly, and should follow the guidelines for size and placement in Section 2B.12 of the MUTCD. They may not be used at signalized crossings. An overhead warning sign can also be used at school crossings, and may be internally lit. It should not be used in conjunction with the diagonally downward pointing arrow.

School Signs and Markings

There are special signs and markings used in school zones. School signs authorized by the MUTCD are shown in Exhibit 8.13. The new standard color for school signs is retroreflective yellow-green. This color can also be applied to sign posts to make them more visible. See Exhibit 8.14. The sign placement requirements discussed below are from the MUTCD. Refer to that document for additional information about design, height, size, placement, and installation of school signs and markings.

ON-PAVEMENT "SCHOOL" MARKINGS

The word "SCHOOL" can be marked on the pavement itself in advance of the school zone as an additional warning to motorists. This marking should only be used to supplement the required warnings signs listed in Exhibit 8.13. See Exhibit 8.15 for the school marking dimensions.

School Speed Zones

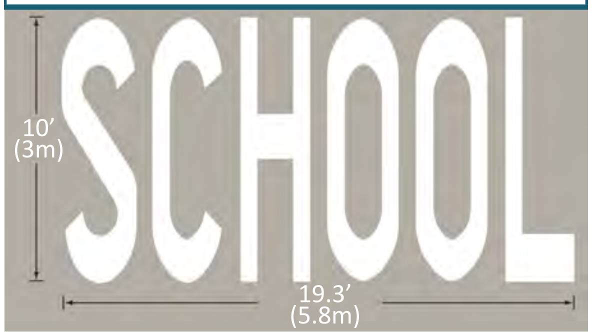
Lower vehicular speeds increase pedestrian safety by reducing the chance of a collision with a pedestrian. In addition, the rate of fatalities is greatly reduced when the vehicular speeds are lower. See Exhibit 8.16. Speed limits in school

** HRS291C-104 addresses speeding in a school zone or construction area: "The director of transportation shall place official signs in school zones. Signs posted pursuant to this subsection shall be plainly visible at all times under ordinary traffic conditions. (c) Any person who violates this section shall be fined $250.00."*

Pavement markings warn motorists of an upcoming school crossing. (Dave Panisi)

EXHIBIT 8.14 *Using the new retroreflective yellow-green sign at schools and crossings alerts drivers to pay extra attention. (Mike Cynecki)*

EXHIBIT 8.15 *In Pavement Markings Across Two Lanes*

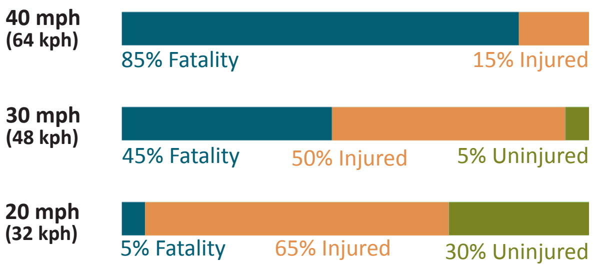


zones can vary, but generally are set somewhere between 15 and 25 mph (24 and 40 kph). Speed limits should be established on the basis of a traffic engineering study or based on the requirements of the local or state jurisdiction. The MUTCD suggests that school speed zones should extend 200 feet in advance of the school, school crossing, or other school related activities. This distance can be increased based on a traffic engineering study. Other traffic calming measures may be more effective than a school speed zone by itself.

Traffic Calming Techniques

Traffic calming techniques that may be appropriate in school zones include raised crossings, refuge islands at crossings, traffic circles, chicanes, bulb-outs, speed humps, narrower streets, on-street parking, a forced one-way route around the school, trees and landscaping along the right-of-way, and gateways. Speed enforcement, radar speed signs, and speed watch programs are also good methods for calming neighborhood traffic in school zones, although their effectiveness may only last for a limited time, unless consistently implemented. Refer to Toolbox Section 2 for

EXHIBIT 8.16 ***Pedestrian Injuries and Deaths at Impact Speeds*** *(Adapted from the National Center for Safe Routes to School "Slowing Down Traffic" webpage)*



Over two-thirds of school-age pedestrians who died in school transportation related crashes were killed by school buses.

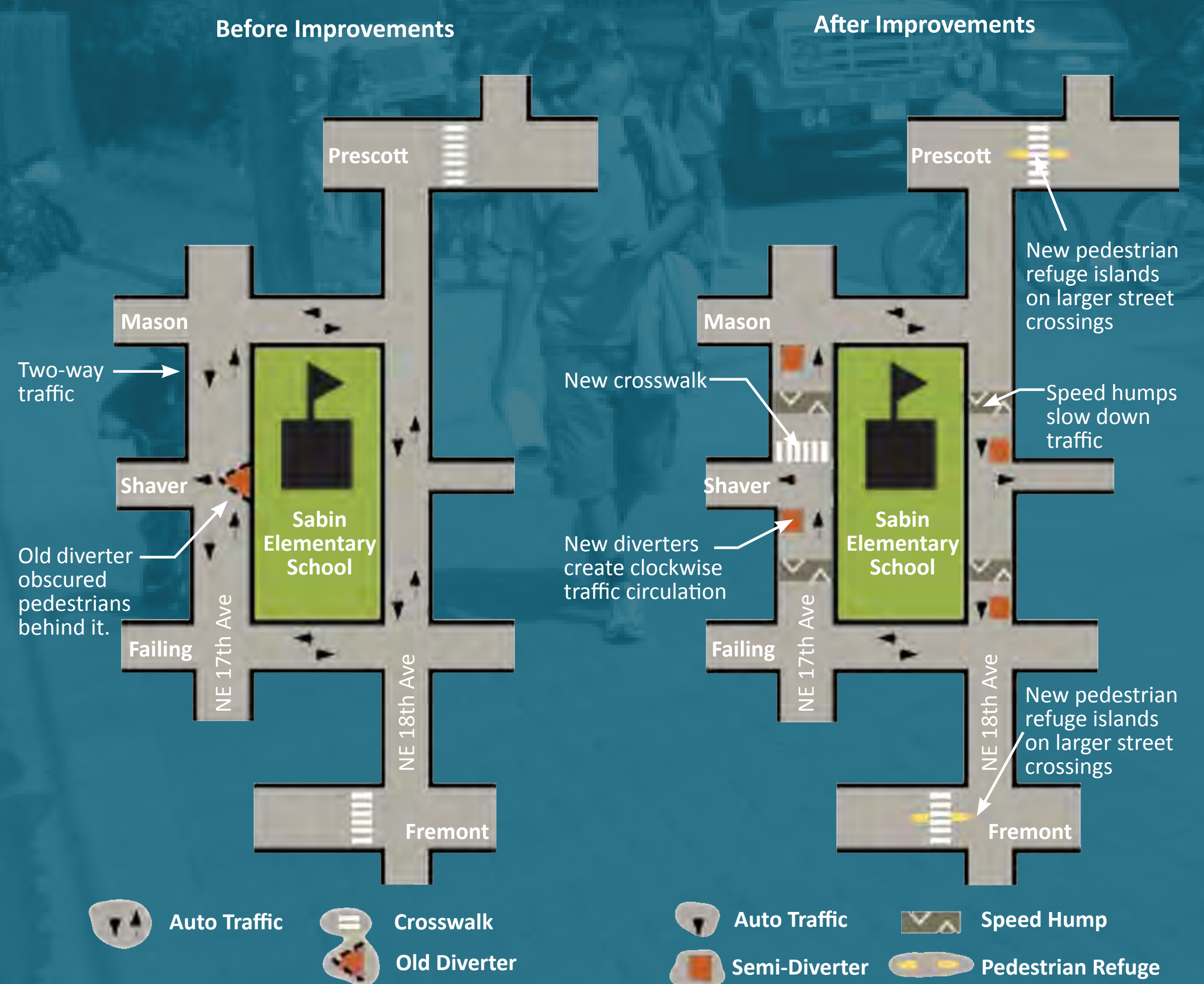
Source: National Highway Traffic Safety Administration, National Center for Statistics and Analysis

CASE STUDY

SABIN ELEMENTARY SCHOOL, PART II

The Sabin Elementary School Study shows how student pedestrian safety can be improved with traffic calming measures, new crosswalks, and pedestrians refuges.

SABIN ELEMENTARY SCHOOL TRAFFIC IMPROVEMENTS



(Graphic adapted from walkinginfo.org Case Study #38.)

Students can learn about pesestrian safety in the classrrom. (Hawaii Safe Routes to School Hui)

Crossing guards can help students in crossing the street safely.

more specific design recommendations related to traffic calming. Traffic calming techniques should be chosen on the basis of a traffic engineering study and with the approval of roadway owners and the school's safety advisory committee.

Signalization and Flashing Beacons

A traffic engineering study should be conducted to determine the need for a signalized school crossing. If a new signal is added, provide pedestrian signal indications and push buttons at signalized school crossings and mark the designated crosswalks. Signal timing should be designed for the age and ability of the students who will use the crossing. Coordinating signal timing with adjacent signals will help minimize traffic disruption. In some cases re-routing the walking route to an existing signal may be preferable to adding a new signal. For a complete discussion on signal placement and design, refer to the MUTCD. See Toolbox Section 5 for more information on intersections, crossings and signalization.

Flashing beacons are commonly used in school zones and are often attached to school speed limit signs. These beacons are only activated during hours that students are present in the school zone. Flashing beacons are discussed in Part 4 – Highway Traffic Signals of the MUTCD, and a mid-block crosswalk is one of the specific applications noted for this device.

Crossing Guards

The use of well-trained adult crossing guards is considered to be one of the most effective methods to improve student pedestrian safety at crossings. Adult crossing guards help children cross the street at key locations and remind drivers of the presence of student pedestrians. A crossing guard program should be developed by a lead organization that brings together key members of the community. This may include school administration, teachers, local traffic engineers, law enforcement officers and parents. The role of this group is to:

1. Identify locations where guards are needed
2. Hire and train guards
3. Provide uniforms and equipment
4. Secure funding

The Safe Routes to School program provides an excellent guide to crossing guards, Adult School Crossing Guard Guidelines. Much of the information in this section is from that document. Refer to it for further information.

Crossing guards should be hired, trained, and supervised by the agency that has jurisdictional authority to do so.

Identifying Locations Where Crossing Guards are Needed

The lead organization determines the criteria for locations that need crossing guards, gathers information about local conditions, and determines the need for the crossing guards. Information to consider includes:

Age of students who are crossing; width of street and number of lanes to cross; sight distance at crossing; safe gaps in traffic; presence of traffic control devices (signals, signs, pavement markings); vehicle speed; traffic and pedestrian volumes; attendance boundary and walk zone for the school; distance of crossing from the school; adjacent land use; crash history at the crossing.

Hiring and Training Adult Crossing Guards

Crossing guards should be hired, trained, and supervised by the agency that has jurisdictional authority to do so. This may be the school district, local law enforcement, transportation departments or local schools. On Oahu, the Honolulu Police Department's (HPD) Traffic Division hires and trains crossing guards.

HPD also runs the Junior Police Officer (JPO) program at schools. Crossing guards are only used at elementary schools.

Volunteer guards may be used, but training, evaluation, and discipline of volunteers can be problematic. Guards should be thoroughly trained in traffic laws, crossing procedures, methods to signal drivers to stop, site-specific factors and potential hazards, and emergency procedures. In addition they should understand the special limitations of children as pedestrians, and be trained in the best ways to communicate with them. They should also understand that they serve as role models to children.

Uniforms and Equipment

Crossing guards should wear uniforms and use equipment that are highly visible and easily identifiable. The uniform should include a retro-reflective traffic vest and should be clearly different from the uniforms of local law enforcement officers. A stop paddle is the most frequently used piece of equipment, and it can be supplemented by a whistle, gloves, and hat.

Lessons about pedestrian safety can be integrated into classroom activities. Here a student has identified problems on the route to school. (Dan Burden, PBIC)

Funding

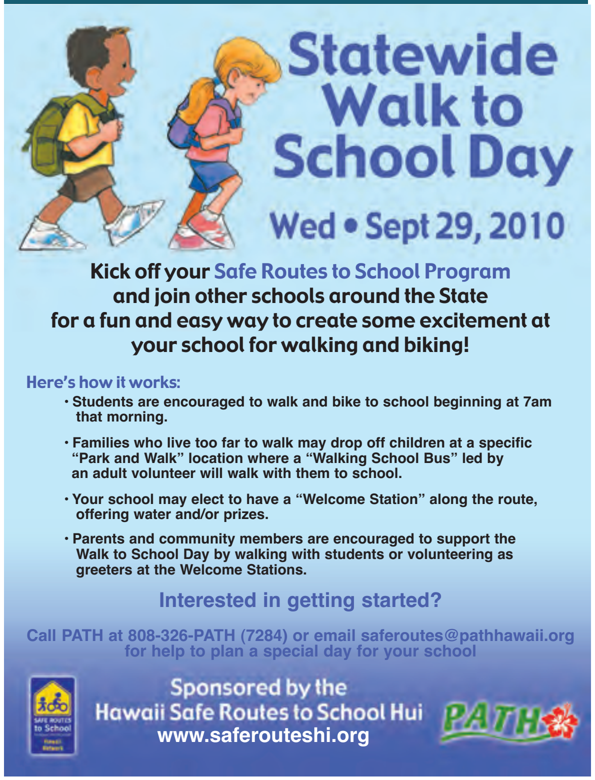
Adequate and steady funding is essential to the success of a crossing guard program. Funding can be obtained through a variety of sources, including taxes, local school boards, sheriff, police, public works and transportation departments, and through surcharges on parking fines. Parent-Teacher Associations and other organizations may also help secure funding.

Educational Tools and Programs for Student Pedestrian Safety

The importance of safety education programs cannot be overemphasized. Audiences include children, parents, drivers and neighbors. All these groups can play a significant role in improving student pedestrian safety. Children need to be taught how to cross a street safely, how to behave around school buses, and how to avoid the inherent dangers of motor vehicles.

Parents need understand their role as teachers and role models to their children, and know the best practices to convey to their children. They also need to understand student drop-off

EXHIBIT 8.17 ***One-time events can encourage students to walk to school.***
(Hawaii Safe Routes to School Hui)



and pick-up safety. ***They should not encourage children to cross streets in order to avoid automobile queuing lines.*** Drivers and neighbors (which include parents) need to understand child pedestrian vulnerability. They need to know where school zones and crossings are and how important it is to obey speed limits in these areas. Neighbors specifically need to understand the value of clearing the sidewalks which border their property and keeping pets on leash.

Teenagers can often behave foolishly and can also benefit from safety programs tailored to their age group. Pedestrian safety programs should be combined with or supplemented by bicycle safety programs as well.

Strategies for conveying safety skills to students include special events, on-going classroom or physical education instruction, integration of safety education into traditional classroom subjects, parent involvement, and structured skills practice. Considerably more information can be found at the ***National Center for Safe Routes to School***.

Many organizations currently exist that can help parents, teachers, and school officials assist in providing safe travel for children. Their websites contain extensive information. Below are some of the tools available.

- The ***National Center for Safe Routes to School*** provides extensive information on all aspects of walking to school and student pedestrian safety. Much of the information in this toolbox section is based on their website. It is part of the University of North Carolina's Highway Safety Research Center, and receives funding from the National Highway Traffic Safety Administration.
- The ***National Partnership for Safe Routes to School*** is a network of more than 500 nonprofit organizations, government agencies, schools, and professionals working together to advance the Safe Routes to School (SRTS) movement in the United States. It sets goals, shares best practices, leverages infrastructure and program funding, and advances policy changes to help agencies that implement Safe Routes to School programs.
- The ***Kids Walk-to-School*** website of the US Centers for Disease Control and Prevention focuses on encouraging students to walk or bike to school, increasing awareness of the importance of physical activity and pedestrian safety, and mobilizing communities to work together to create safe routes to school. Their ***Guidebook*** provides extensive information on how to promote walking to school.
- ***Walk to School***—an organization devoted to encouraging walking to school and recognizing the need to create safe walking communities for children.
- ***Walk Wise Hawaii (WWH)*** is an HDOT public education program that works through community partnerships, presentations and the media to educate pedestrians and drivers on safe walking and driver awareness of pedestrians.

Ongoing Maintenance

The school district and school site officials are responsible for providing ongoing maintenance of pedestrian facilities and traffic control elements on the school site. This includes sidewalks within the right-of-way adjacent to the school site. Public and private property owners are typically responsible for repairs and reconstruction of the sidewalk within the street right-of-way adjacent to their property. State, local, or county jurisdictions are responsible for maintaining facilities and traffic control elements at intersections and mid-block crossings. Before the opening of school each year, elements that affect pedestrian travel in the area of the school should be inspected. Some of the things to look for include:

- Signs that are clearly visible and easy to read (paint has not worn off; tree branches are not in the way, it has not been vandalized or knocked down)
- Traffic control devices, signals, and actuators that function properly
- Sidewalks and walkways that are clear of obstruction; pavement that is smooth
- Crosswalks and pavement markings that are clearly visible
- Pedestrian's visibility that is not compromised by overgrown landscaping, parking, signs, fencing, or other obstacles at intersections, crossings, and along walkways

Other Resources

For more specific design guidelines for various pedestrian facilities that may be developed within the vicinity of schools, refer to other toolbox sections. The following resources provide additional information related to pedestrian facilities and educational programs for children and school zones.

- Federal Highway Administration Safe Routes to School program development guidance. Website: ***http://safety.fhwa.dot.gov/saferoutes/*** (May 2013).
- Federal Highway Administration. *Manual on Uniform Traffic Control Devices.* 2009.
- Florida, State of. *Florida Pedestrian Planning and Design Handbook.*
- Institute of Transportation Engineers, Traffic Engineering Council Committee TENC-5A-5, Zegeer, Charles V. (Chair). *Design and Safety of Pedestrian Facilities, A Recommended Practice of the Institute of Transportation Engineers.* 1998.
- National Center for Safe Routes to School. Website: ***http://www.saferoutesinfo.org/*** (May 2013).
- National Center for Safe Routes to School and National Highway Transportation Safety Association. Adult School Crossing Guard Guidelines. Safe Routes to School website: ***http://guide.saferoutesinfo.org/crossing_guard/*** (May 2013).
- National Highway Traffic Safety Administration, National Center for Statistics and Analysis, *School Transportation Related Crashes.* Publication No. DOT 811 165. Website: ***http://www-nrd.nhtsa.dot.gov/Pubs/811165.PDF*** (May 2013).
- Oregon State Department of Land Use, Conservation, and Development. *Neighborhood Street Design Guidelines: An Oregon Guide for Reducing Street Widths.* 2000. Website: ***http://www.oregon.gov/LCD/docs/publications/neighstreet.pdf*** (May 2013).
- Safe Routes to School National Partnership. Website: ***http://www.saferoutespartnership.org/home*** (May 2013).
- Walkinginfo.org School Zone Improvements. Website: ***http://www.walkinginfo.org/engineering/schools.cfm*** (May 2013).

- Walk Wise Hawaii Website: ***http://hawaii.gov/dot/highways/safe-communities/walkwisehawaii*** (May 2013).
- Washington State Department of Transportation. KJS Associates Inc., MacLeod Reckord, and Educational Management Consultants. *A Guidebook for Student Pedestrian Safety, Final Report.* 1996.
- United States Access Board. *Public Rights-of-Way Accessibility Guidelines (PROWAG).* Draft-rulemaking in process. Website: ***http://www.access-board.gov/prowac/*** (May 2013).
- United States Access Board. *ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).* (Reference for applicable requirements to school site design) Website: ***http://www.access-board.gov/adaag/html/adaag.htm*** (May 2013).
- United States Centers for Disease Control. *Barriers to Children Walking and Biking to School.* 1999. Website: ***http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5132a1.htm*** (May 2013).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TOOLBOX SECTION 9

Special Pedestrian Districts and Site Design for Pedestrians

People like to live and vacation in areas where they can walk, with readily accessible sidewalks, paths, trails, and other pedestrian facilities.

SPECIAL PEDESTRIAN DISTRICTS AND SITE DESIGN FOR PEDESTRIANS

The Value of Pedestrian-Friendly Development

Pedestrian-friendly development encourages people to walk more. When people walk more, they are more physically fit and have less health problems. Walking more and driving less also reduces greenhouse gas emissions and results in other environmental benefits.

Good pedestrian design also brings economic benefits. Several case studies have shown that higher levels of retail activity occur in shopping areas and tourism districts that have been designed to be pedestrian-friendly. Walkable places attract consumers. Research also has shown that pedestrian-friendly development increases real estate values. People like to live and vacation in areas where they can walk, with readily accessible sidewalks, paths, trails and other pedestrian facilities. As such, housing and vacation destinations in walkable areas are in higher demand and of higher value.

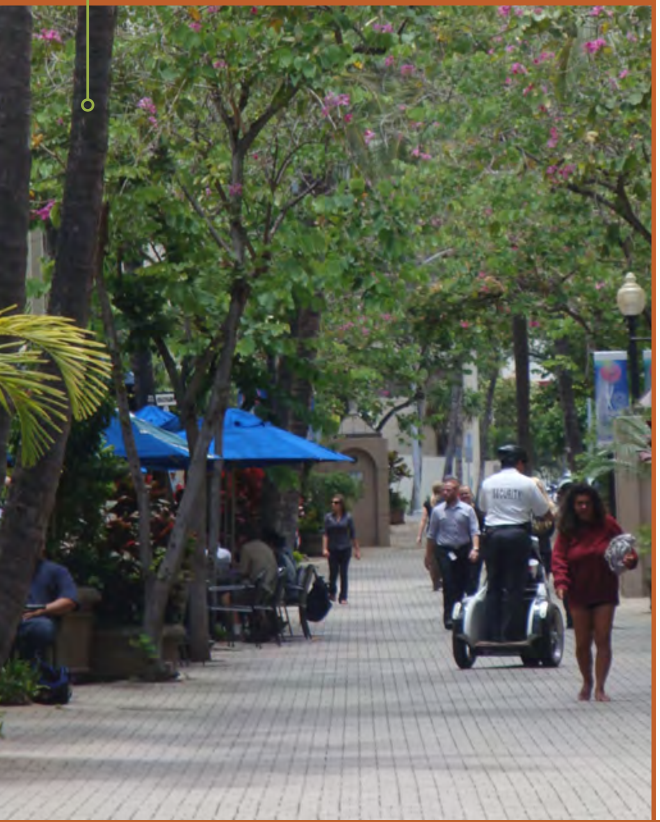
Generous sidewalks, pedestrian corridors, plazas, curb extensions, accessibility features, pedestrian signals, marked crosswalks, special paving, street trees and landscaping, furnishings, public art, pedestrian scale lighting, and wayfinding are frequent elements of pedestrian-friendly developments.

Street trees, landscaping, and furnishings are frequent elements of pedestrian-friendly districts and areas.

IN THIS SECTION

Pedestrian oriented lighting, special paving, and vegetation create a pleasant pedestrian environment.

Private investment in development can serve an important role in creating vibrant, walkable places.



Planning for All Transportation Modes as Part of Site Development

The vitality of developments is strengthened when adjacent streets and on-site facilities serve a mix of transportation modes (pedestrians, bicyclists, transit, and motor vehicles). A well-designed site addresses the needs of all these modes of transportation. During the early planning stages of any development, the project team should consider how to cohesively address the needs of all transportation modes. This includes identifying the need for on-site networks and facilities, as well as the need for connections to surrounding streets and transportation networks.

Analyzing and addressing the needs of all modes, including pedestrians, as part of project planning rather than later in the design process, or after construction (as an afterthought) will save costs in the long-run by minimizing the need to add sidewalks and other facilities later. As the planning process proceeds into design and construction, it is important that the needs of all modes continue to be considered and addressed.

Public/private partnerships in creating pedestrian-friendly development can be "win-win" opportunities. Private investment in development can serve an important role in creating vibrant, walkable places with active street frontages, sidewalks, and a variety of pedestrian amenities and public spaces. Public investment in pedestrian-friendly and complete street improvements can increase real estate values, attract new customers and tenants, and catalyze redevelopment. Public and private partnerships and cooperation can maximize the value of these investments while at the same time enhancing overall community livability and economic vitality. For more information related to planning for pedestrians, refer to Toolbox Section 1—Thinking About Pedestrians from the Start.

Pedestrian-Friendly Site Design

Because all trips begin and end as pedestrian trips, providing a well-designed pedestrian network on development sites (shopping centers, mixed use areas, campuses, resorts, residential sites, office complexes, etc.) is crucial.

Examples of pedestrian-friendly site design approaches that can be integrated into development (and potentially incentivized or required through local code provisions) include:

- Working with architects and site designers to establish a strong, vibrant building edge that creates a comfortable and attractive space for pedestrians;
- Allowing more flexibility in parking options, such as shared parking or the use of on-street parking as part of the required parking quantity;
- Encouraging mixed-use development; and
- Providing public pedestrian space at the ground level, including public pass-through corridors through the development of site and forecourt plazas open to public use.

Circulation systems for all modes of transportation need to be integrated into site design. Special design considerations are required where these systems intersect, with pedestrian safety being the highest priority, as a best practice. As much as possible, pedestrian travel ways should be separated horizontally and/or vertically (via curb-height walkways) from vehicle travel ways.

The following simple approach can help designers envision a good pedestrian environment when reviewing a site design for the first time. Designers and developers should consider the point-of-view of a pedestrian walking through the site and ask themselves several questions:

- Are there continuous pedestrian routes throughout the site?
- How direct are these routes? Is there direct pedestrian access to and from the site via adjacent sidewalks?
- Do walkways keep pedestrians out of the middle of parking lots?
- How easy is access between the site and nearby transit stops?

By considering these and other questions, the needs of pedestrians will be addressed as a basic premise of the overall site design process. See the checklist of pedestrian-friendly site design solutions on the next page.

Exhibit 9.1 shows a site development with many of the elements of good design for pedestrians.

Providing a well-designed pedestrian network on development sites is crucial. *(Adapted from an illustration by the Miller Hull Partnership)*

PEDESTRIAN-FRIENDLY SITE DESIGN CHECKLIST

- ✓ *Delineated walkways through parking lots*
- ✓ *Connections to neighborhoods and surrounding areas*
- ✓ *Easy to identify building entrances*
- ✓ *Building frontages located along streets rather than parking lots*
- ✓ *Convenient and safe access to transit and adjacent sidewalks*
- ✓ *Alignment of walkways for convenience and reduced travel distances*
- ✓ *Accessible routes of travel to and from the site, as well as throughout the site*
- ✓ *Absence of barriers to pedestrian travel (e.g. walls, ditches, landscaping, or roads without safe crossings)*
- ✓ *Pedestrian-friendly architectural design (awnings, active frontages along streets, visible and well-lit building entrances, etc.)*

EXHIBIT 9.1 A Well Designed Site for Pedestrians

Site Elements

How various site elements are designed can greatly affect pedestrian use of the site. Some key site elements include:

- Site Edges
- Building Location and Design
- Site Circulation
- Walkways and Accessible Routes
- Site Access and Driveway Design
- Ramps, Stairways, and Steps
- Landscape and Furnishings
- Public Art

These elements should be designed to enhance pedestrian use and create an overall pedestrian-friendly site, whether a residential neighborhood, mixed use development, shopping center, tourist destination, or business center. Pedestrian design guidance related to each of these elements is provided below.

SITES EDGES

When designing pedestrian facilities, it is important to consider what defines the edges of these areas. Defining elements may include buildings, street trees, planter strips, and sidewalks. Building design should respond appropriately to existing or planned pedestrian uses and include architectural treatments that enliven the pedestrian space. Blank walls are uninviting and uninteresting to walk next to. The most successful pedestrian designs provide edges that are visually engaging.

It is also important to buffer the sight and sound of traffic from a pedestrian space. Street trees, bollards, berms, and low walls can create a buffer without compromising good security surveillance into the space. The splash and gurgling of water features can help mask the sound of traffic.

BUILDING LOCATION AND DESIGN

Building location and architecture can encourage pedestrian access by providing an attractive and welcoming environment.

- Locate buildings directly adjacent to the sidewalk along the street right-of-way. This allows pedestrians to access the buildings directly from the street, encouraging a friendly street atmosphere, and avoids

Mural and landscaping create an attractive façade along a large commercial building.

Lively building facades with obvious entries promote a friendly environment for pedestrians, as shown in this Waikiki example.

This pedestrian crossing is well positioned to provide access to a shopping area at this Honolulu location.

forcing pedestrians to cross parking lots to get to building entrances.

- Lay out buildings and other site elements in configurations that define spaces for people to walk and gather around the site. Create opportunities for pedestrian gathering spaces, plazas, and pocket parks (see Exhibit 9.2).
- Encourage building design that reflects the character of the surrounding neighborhood or district and responds to the preferences of the community.
- Design building walls and finishes to pedestrian scale, especially on the sides of the building that face streets, sidewalks, and plazas. Architectural elements such as windows, balconies, and entries should be encouraged. Blank building facades that are uninviting should be avoided.
- In some cases, such as with large commercial and retail buildings (big box), windows may not be desirable along the façade. Murals, artwork, architectural details, and/or landscaping can be used to dress up the façade to avoid blank walls along the pedestrian space (see photo example on previous page).
- Use building layout, overhangs, awnings, or other features to provide shade and weather protection.
- Soften hard surfaces with color, texture, landscaping (climbing vines), and other techniques, and bring human scale to building frontages.
- Include wide storefront walkways to welcome pedestrians to businesses and buildings.

For more information related to sidewalk design, including dimensional guidelines, suggested surfacing materials, and other treatments, refer to Toolbox Section 2—Pedestrian-Friendly Streets and Toolbox Section 4—Sidewalks and Walkways.

SITE CIRCULATION FOR PEDESTRIANS

One of the biggest concerns for pedestrians in site design is the potential for conflicts with motor vehicles. The following design strategies can minimize conflicts and help clarify pedestrian circulation.

- Clearly define pedestrian access ways. Striping, delineation of walking zones with curbs, landscaping, centralized walkway

EXHIBIT 9.2 *A pedestrian plaza can be a lively social and civic space.*

EXHIBIT 9.3 *Building entries should be easily accessible from the street.*

medians and islands, and textured paving are all good ways to define walking spaces.

- Illuminate pedestrian walking areas through parking lots with pedestrian scale lighting if possible.
- Provide adequate drainage to avoid puddles and runoff areas across pedestrian walking routes.
- Provide separate pedestrian access to parking garages and structures.
- Provide direct access to building entrances from the street and sidewalk. Exhibit 9.3 illustrates a building entrance directly accessible from the street.
- Design parking lots so they can be shared by more than one building on the site or by buildings on neighboring sites. In Exhibit 9.4, three buildings share a single parking area.
- Provide one-way traffic flow through parking lots where appropriate to minimize conflicts with automobiles.
- Minimize pedestrian crossings in vehicle circulation zones.
- Use raised crossings, speed humps, and speed tables to discourage high traffic speeds in parking lots and on drive aisles and vehicle circulation areas.
- Limit parking in certain areas as a strategy to increase pedestrian trips and transit use, and decrease motor vehicle use.
- Avoid locating pedestrian walking areas near truck and freight delivery zones and trash enclosures. Trucks backing up without being able to see pedestrians is a common cause of crashes.
- Provide well delineated and marked drop off and pick up zones for pedestrians that are separated from the flow of vehicle traffic. These areas should be designated as no parking zones.
- Locate transit stops near the site and close to important destinations within it.

WALKWAYS AND ACCESSIBLE ROUTES

Layout of walkways and paths as part of site design is important for making the site efficient, accessible, comfortable, and safe for pedestrian travel. Walkways and paths should generally be

Farmers market in Downtown Honolulu

EXHIBIT 9.4 ***A shared parking lot conserves space and creates a more pedestrian-friendly environment.***

aligned along the most direct routes because pedestrians will walk along routes that are the most convenient and lead directly to their destinations. Paths can also be created to follow existing or anticipated "desire" lines. Meandering walkways should be avoided.

Americans with Disabilities Act (ADA) accessible design standards require all sites to provide an accessible route of travel between accessible site elements such as parking areas, buildings, transit stops, perimeter sidewalks, and other facilities. An accessible route is a clear level walkway that provides access for all pedestrians, including people with disabilities. Specific design requirements related to accessible routes of travel are provided in Toolbox Section 3—Accessibility.

Providing pedestrian connections to adjacent parcels, as well as public lands can be important too. Developers should work with adjacent landowners and public agencies to foster connectivity between their parcels. For example, it can be advantageous to strengthen connections between two commercial sites, between a commercial site and a residential site, and between mixed-use areas and public spaces such as waterfronts.

Walkway design treatments that can help to improve conditions for pedestrians include the following:

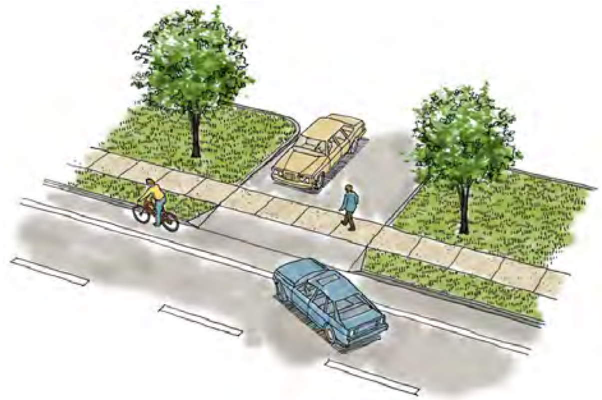
- Covered walkways and shelters to increase pedestrian comfort and provide protection from the elements;
- Well illuminated walkways and corridors to increase pedestrian security; and
- Raised walkways through parking areas to more clearly define the pedestrian travel way. (Note: curb cuts must be provided if walkways are raised.)

SITE ACCESS AND DRIVEWAY DESIGN

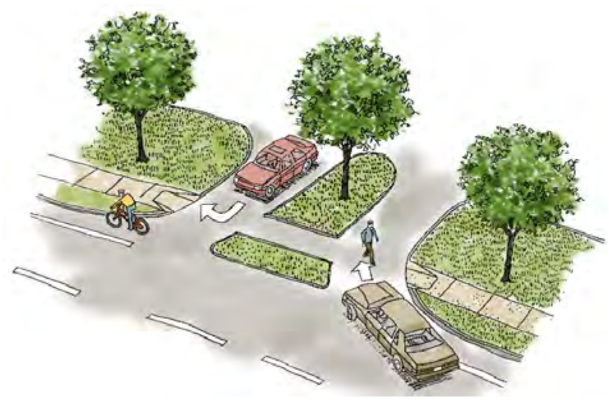
Access management and driveway design can contribute to pedestrian mobility and safety. Access management suggestions include the following:

- Limit the quantity and frequency of driveway access points and entrances to sites from streets to minimize interruption of pedestrian travel on adjacent sidewalks and walkways.
- Design sites so that adjacent properties can share access points and parking where possible.

EXHIBIT 9.5 ***Site Driveway Design***



Most Desirable: This design provides a delineated walkway across a narrowed driveway neck (with a conventional driveway apron). The pedestrian travel way is clear to the driver. The crossing distance is minimized, and the walkway stays at a constant grade.



Acceptable: This design is suggested for commercial driveways when it is not feasible to provide a conventional driveway apron design. The design still treats the driveway like a street intersection, but it limits the driveway width to one lane in each direction and provides a refuge island for crossing pedestrians. Striping the pedestrian travel way would improve this design.

Not Recommended: A very wide driveway with no refuge for pedestrians and undelineated crossing area. The driveway resembles a street intersection, which encourages higher speed turns and discourages stopping for pedestrians since their right-of-way is not clearly delineated. The movement of the vehicle clearly takes priority over crossing pedestrians.

- Separate pedestrian and vehicle access to and on the site to minimize conflicts.
- Design emergency vehicle access to allow quick access and minimize conflict with pedestrians.

Driveways can be designed or retrofitted so that they are easier for pedestrians to cross. Narrow driveways shorten the crossing distance, decreasing the likelihood of a conflict with a motor vehicle. The provision of clear sight lines between the pedestrian and the motorist pulling out of or into the driveway is very important. When selecting an appropriate driveway design, consider the type of facility and roadway classification, while also keeping in mind the best practices for pedestrians.

Driveways that provide access to businesses, offices, or other commercial buildings can be built as conventional driveways or with designs that resemble street intersections (with right-in/right-out access control). For pedestrian safety and comfort, the conventional driveway design is more desirable, because motorists are forced to slow down when turning into the driveway, and the pedestrian right-of-way is more clearly established. (This design is also safer for bicyclists: they also have less distance to cross.) Exhibit 9.5 illustrates three different driveway designs.

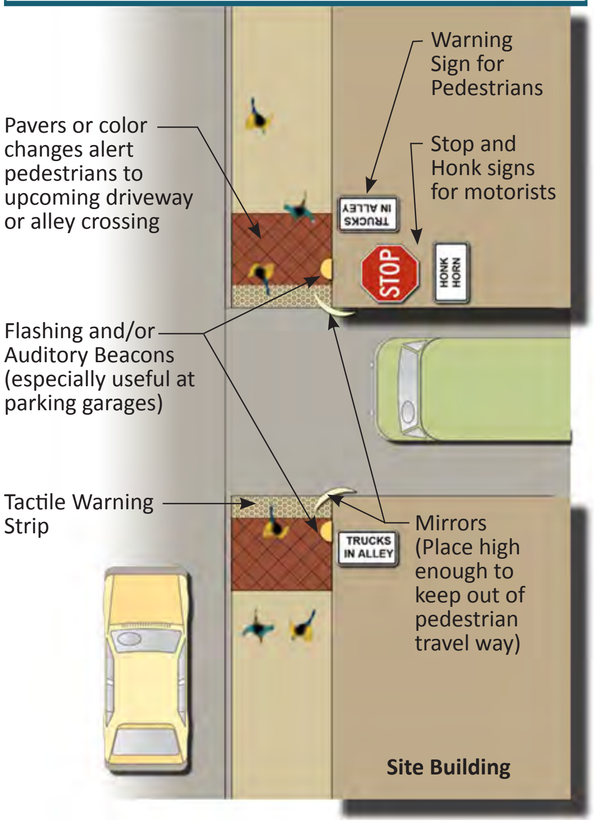
Sidewalks that cross driveways and alleys can be problematic if sight distance is limited by adjacent buildings, landscaping, or other elements. Drivers pulling into or out of the driveways are concentrating on the flow of vehicular traffic and may not notice pedestrians. Several measures can be applied to improve pedestrian visibility and make these crossings easier for pedestrians. These are illustrated in Exhibit 9.6 and include the following.

- Warning signs for pedestrians
- Stop and warning signs for drivers
- Visual and/or auditory warning beacons
- Mirrors placed in strategic locations to see around corners into alleys or parking garage driveways
- Unit pavers or colored pavement to delineate area

Wide planting buffers between the sidewalk and street create advantages for pedestrians at

Successful pedestrian environments provide furnishings and create attractive settings for pedestrians to move through, gather, rest, socialize, and orient themselves.

EXHIBIT 9.6 *Pedestrian Treatments at Alleyways*



If alleyways are blocked by buildings, special treatments should be used to increase pedestrian safety and comfort.

driveway crossings. These benefits are shown in Exhibit 9.7.

RAMPS, STAIRWAYS, AND STEPS

Stairways and steps should be avoided wherever possible. Instead, the use of universal design that avoids grade differences in pedestrian areas is preferred. Accessible ramps are preferred over stairs to address unavoidable grade changes, and ADA requires that all publicly-accessible buildings have accessible entrances. If steps or stairways are proposed in site designs, basic guidelines for stair and landing dimensions, step dimensions, tread-to-riser ratio, and tread nosing design should be followed. These are shown in Exhibit 9.8. According to *Time-saver Standards for Landscape Architecture*, the minimum width of public stairways should be 5 ft (1.5 m), and the minimum width for private stairways should be 3.5 ft (1.1 m).

More information about ramp design is provided in Toolbox Section 3—Accessibility.

LANDSCAPING AND FURNISHINGS

Successful pedestrian environments provide furnishings and create attractive settings for

EXHIBIT 9.7 *Wide planter strips create numerous benefits for pedestrians at site entrances.*

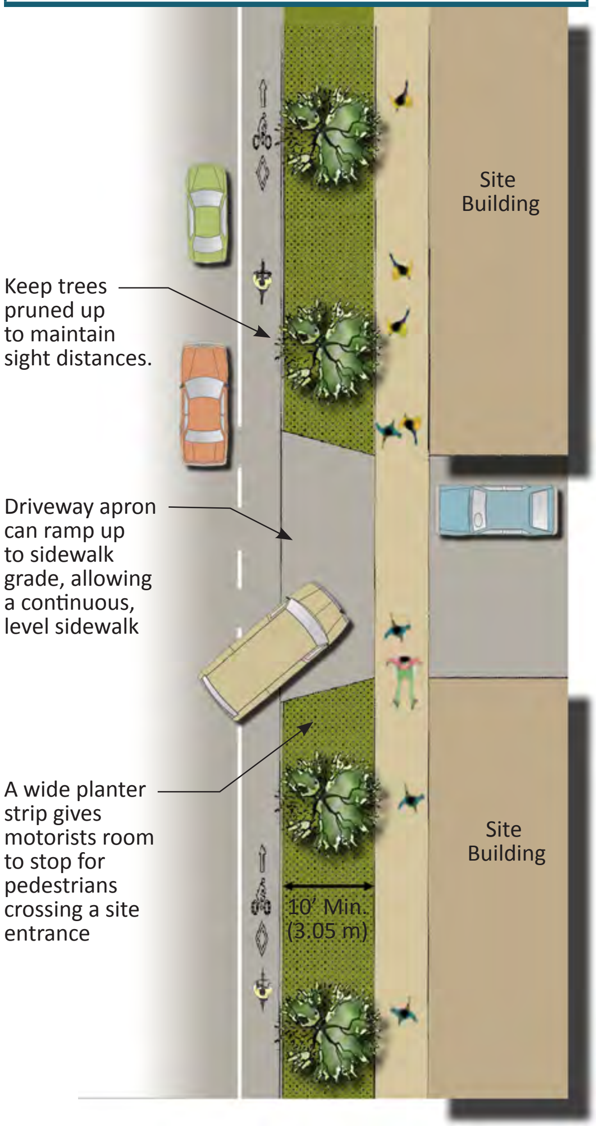
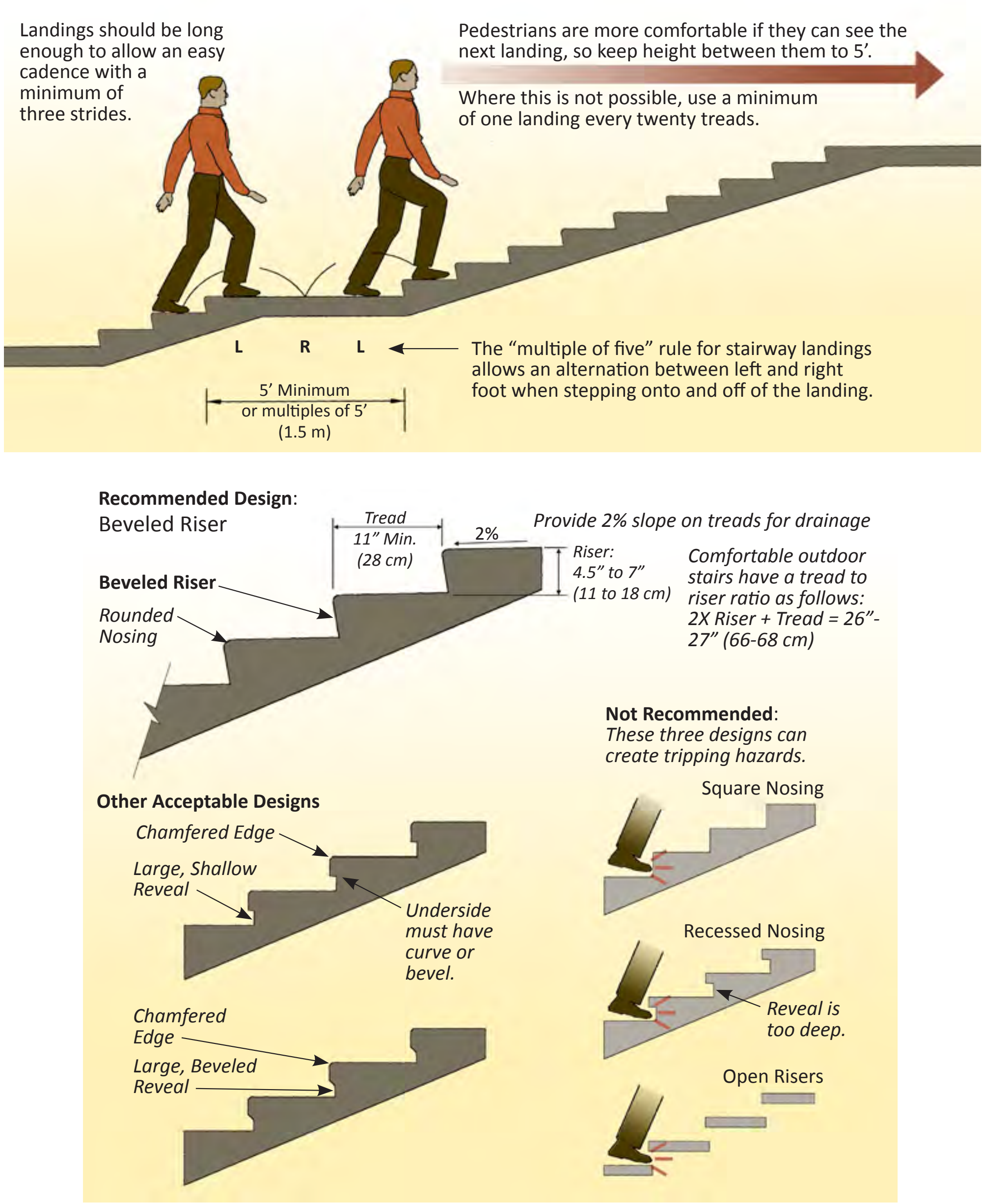


EXHIBIT 9.8 Stair Design



pedestrians to move through, gather, rest, socialize, and orient themselves. Refer to the HDOT *Sustainable Landscape Master Plan* (to be released in the future) for landscaping standards. Elements that contribute to the success of pedestrian sites include the following.

- Plazas, displays, and exhibits that draw pedestrians to the building
- Benches or seating areas outdoors or in building alcoves, to allow pedestrians to stop and rest
- Pergolas and tables with umbrellas to provide shade
- Displays, signs, and retail features to attract pedestrians
- Water features that mask noise (such as traffic) and provide comfort and enjoyment
- Trees with heights and forms complementary to human scale, with upward branching habits along walking areas, and with the capability to provide shade and shelter; tree species with non-aggressive roots should be chosen to avoid buckling of adjacent pavement

Public art can be whimsical and unexpected. (Zach Everson)

The Mana Nalu Mural in Honolulu. Murals add drama to public spaces and celebrate culture and history. (www.illusion-art.com/John Pugh)

- Perimeter landscaping with defined edges to reduce the impact of parked vehicles and enhance the streetscape
- Shrubs and ground covers that don't block walkways or interfere with visibility and security
- Strategically located trash receptacles and cigarette ash cans that help keep an area clean and attractive

Limbed-up street trees provide generous shade and a valuable connection to nature in urban areas.

- Public artwork to create interest in a place as a destination (see this page)

While furnishings are good for pedestrian environments, they should not protrude into the pathway of pedestrians.

PUBLIC ART

Public art encourages a sense a place, provides a focal point in public spaces, and can create a memorable experience for pedestrians. It can be an integral component of pedestrian site design, whether public or private. Many street furnishings can be designed as public art elements or with integrated art features. Examples include bus shelters, bike racks, bike lockers, railings, banners, and benches. These features can do double duty, providing their functional value and offering aesthetic enjoyment. Public art can also include stand-alone sculpture, bas-relief images on architectural elements, murals, and other pieces inspired by the artist's imagination, and limited only by space, budget, and jurisdictional approval. Art also can be integrated into private developments, serving many of the same purposes it does in the public domain.

EXHIBIT 9.9 *Designing Furnishings and Treatments as Public Art*

Traditional Furnishings and Treatments	*Furnishings and Treatments as Public Art*

Black Metal Railing

Twig Railing

Colored Metal Bench and Trash Receptacle

Attractive Cut-out Designs and Stamps

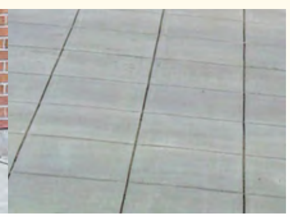
Traditional Bollard

Aluminum Bike Box

Large Round Bollards

Decorated Bike Box and Mural

Loop Bike Rack



Scored Concrete

Potato Masher Bike Rack

Playful Bronze Inlays in Sidewalk

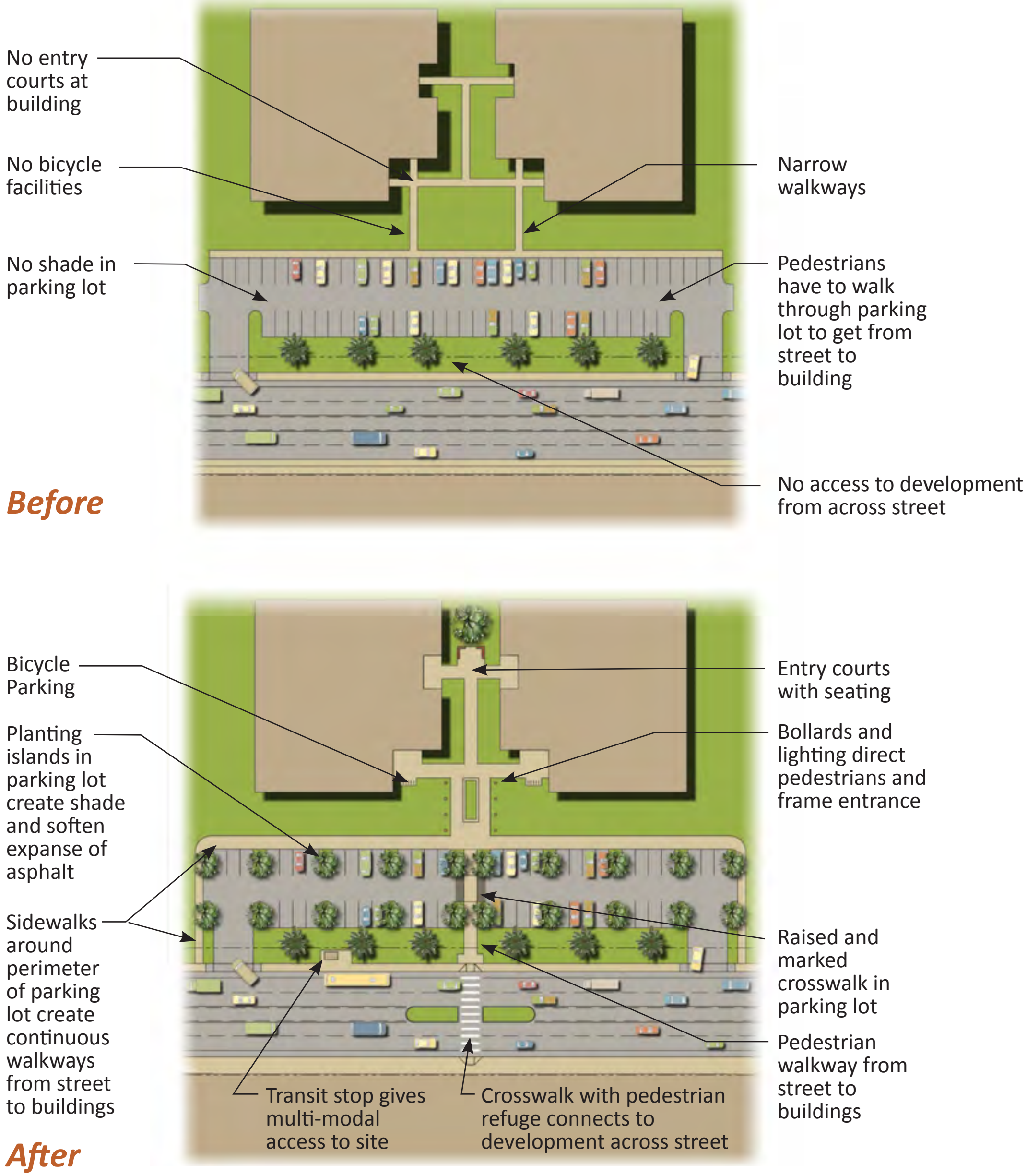
Retrofitting Existing Developments

Even developments that weren't initially designed with good pedestrian accessibility and connectivity can be retrofitted and improved. Often, just a few minor, low cost improvements can go a long way in improving pedestrian safety and mobility and attracting more pedestrians. This may include the addition of pedestrian walkways in areas where there are none, sidewalk widening to accommodate more pedestrians, delineated walking areas through parking lots, sprucing up a streetscape, or adding pedestrian-friendly features along a building frontage (awnings, benches, public art, etc.) Refer to Exhibits 9.9 and 9.10.

Suburban Neighborhoods and Subdivisions

The places where people live—residential neighborhoods and developments—also need to be pedestrian-friendly. Low-density single family developments and subdivisions that lack sidewalks and have cul-de-sac streets (common in many suburban areas), can be challenging places for pedestrians. New urbanism and neo-traditional neighborhood designs with higher connectivity offer a better alternative to the suburban street

EXHIBIT 9.10 ***Existing Developments Retrofitted to Create a Better Pedestrian Environment***



configurations developed in mid to late 1900s. One important characteristic of the new urbanist neighborhoods is that the garage entrances face the alleyways, resulting in no driveway curb cuts along the primary streets, resulting in a more pedestrian-friendly environment. New urban and neo-traditional residential developments are characterized by a mix of housing options and land uses, a well connected multimodal street network or grid system, narrower streets, and connections to transit.

In existing suburban areas where cul-de-sacs or street dead ends limit pedestrian connectivity, path cut-throughs and linkages can be provided. Many suburban neighborhoods across America are also adding new sidewalks and paths. Retrofitting neighborhoods with pedestrian facilities enhances residents' health and quality of life. Exhibit 9.11 on page 9-17 compares a cul-de-sac layout with a neo-traditional neighborhood design. Yellow lines show where paths can be provided to improve connectivity in the cul-de-sac neighborhood.

Bicycle-Friendly Site Design

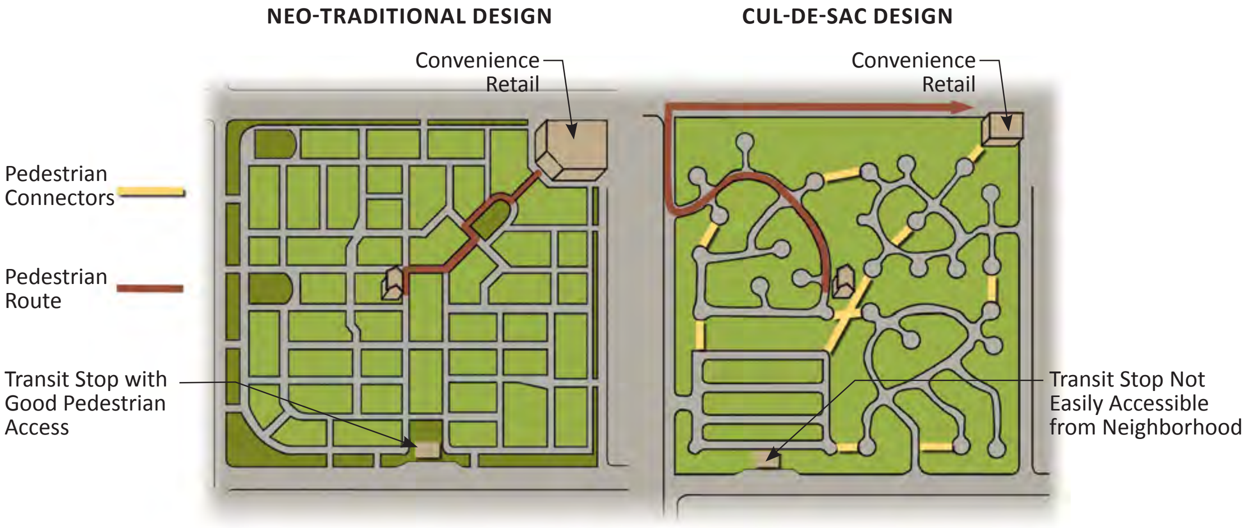
Bicyclists' needs are an important consideration in site design and development. Bicycle facilities and amenities should be provided when designing or retrofitting a site. Bicycle access from the street to the business or office should be provided via a separate path or a bike lane in the roadway (or via shared use on low volume, low speed roads and driveways).

Conveniently located bicycle racks and lockers encourage bicycle trips and commuting. Requiring bicycle parking in new development and redevelopment can also support bicycle travel. One approach is to establish bicycle parking requirements relative to expected demand based on land use. Another approach is to require that bicycle parking spaces be provided in proportion to the total number of automobile parking spaces (often 1:10). Or it may be desirable to reduce motor vehicle parking and increase bicycle parking in some locations.

If businesses are located close together, a shared bicycle rack can reduce costs and create an arrival space for bicyclists. To further encourage bicycle commute trips, employers can provide showers and changing facilities for their bicycle commuters. See *Bike Plan Hawaii* for more information.

Design circulation to avoid conflicts between bicyclists, pedestrian, and motorists. Avoid situations that might result in bicycle travel on sidewalks or pedestrian paths, unless the paths are designed specifically for shared use with adequate width (see Toolbox Section 7—Shared Use Paths).

EXHIBIT 9.11 A Comparison of Neo-Traditional and Cul-de-Sac Neighborhood Designs
(Adapted from the National Center for Safe Routes to School website information)



Neo-traditional neighborhood design creates short routes between destinations with multiple connections throughout the neighborhood.

Cul-de-sac design creates long pedestrian routes and forces pedestrians and motorists out to arterial streets. Pedestrian connectors can alleviate this problem.

Transit-Friendly Site Design

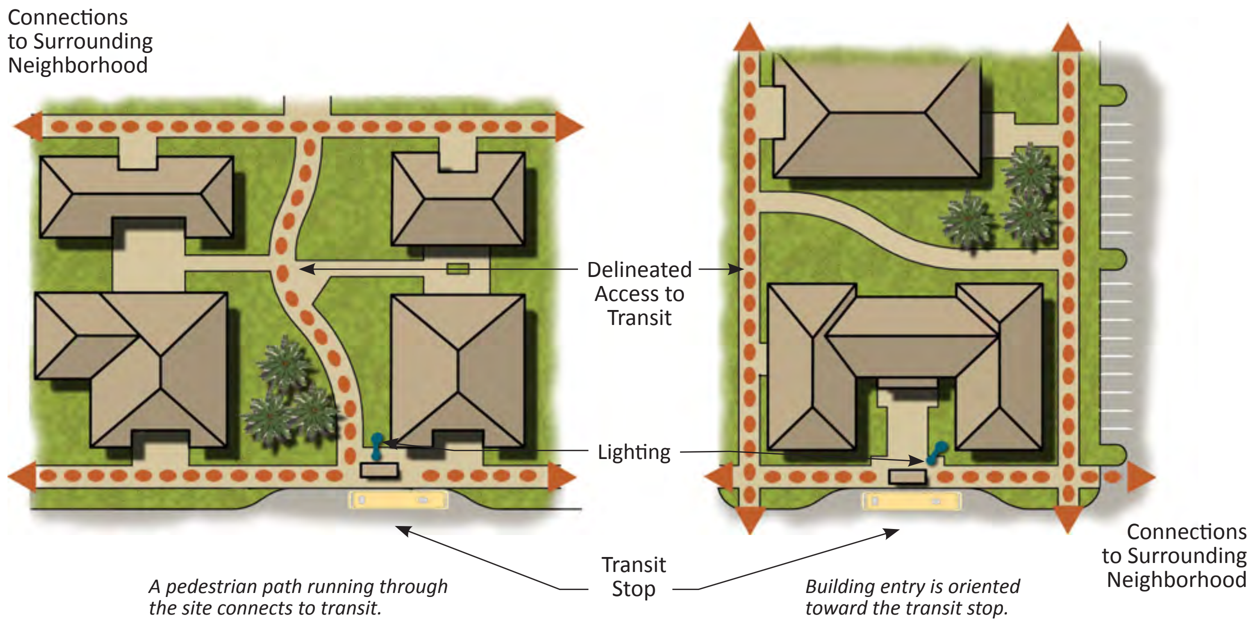
Designers and developers should consider existing transit service as well as the potential for future or additional transit service at or adjacent to their site. If the site is along an existing transit route, it may be appropriate to coordinate with the transit agency to add a transit stop if the new development will be expected to generate transit use. If a transit stop is installed within a site, it should

SUCCESSFUL MIXED-USE SITE DESIGN CHECKLIST

- *Are the uses complimentary?*
- *Are the uses located within convenient walking distance of each other?*
- *Are the uses linked by sidewalks or paved paths?*
- *Are the walking routes short and direct?*
- *Do the buildings fit with and complement each other?*
- *Do the uses create activity at different times of day?*
- *Is parking kept out of the pedestrian's path of travel?*
- *Do the uses support one another economically?*

Source: A Guide to Land Use and Public Transportation, Volume II: Applying the Concepts, The Snohomish County Transportation Authority

***EXHIBIT 9.12** Good access to transit is an important feature of pedestrian districts.*



be designed to meet local transit design requirements. (See Toolbox Section 6—Access to Transit for design guidelines.)

Employers can often provide incentives to commuters who take transit. Check with regional and local planning agencies to confirm existing commute trip reduction programs. See Exhibit 9.12 for an example of providing good pedestrian access to transit as part of site design.

The Benefits of Mixed-Use Development

Mixed-use development was an integral component of traditional towns built before the rise of the automobile. However, since the mid-1900s, arrangement and design of land uses has often been scaled to driving rather than walking. Today's Americans are seeking a return to the more livable, walkable neighborhoods of the past. The pendulum is swinging back now, toward mixed-use site development, where compatible

EXHIBIT 9.13 Mixed-Use Site that includes Several Complementary Land Uses, Shared Parking, and Access to Transit

If businesses are located close together, a shared bicycle rack can reduce costs and create an arrival space for bicyclists. (Ferut Architects)

A generous building forecourt can create a vibrant pedestrian space.

Pedestrian exclusive areas should be perceived as both a destination and a pedestrian thoroughfare that connects a diversity of active users.

BASIC CRITERIA OF SUCCESSFUL MIXED-USE DEVELOPMENT

- *Complementary land uses such as residential and/or office with retail and restaurants and accessible to transit service*
- *Located within convenient walking distance of each other, usually ¼ to ½ mile or less*
- *Connected by safe, direct walkways*

land uses are developed on a single site or within a compact district. This may mean housing units above retail or commercial spaces within a single building, or a mix of land uses within a site, all located within convenient walking distance.

Local zoning ordinances should encourage mixed-use development, and mixed-use development should be allowed within or near single-family residential districts. Exhibit 9.13 illustrates a mixed-use site development concept.

Special Pedestrian Districts

Special pedestrian districts are common in many urban areas and town centers of communities. In successful walking/shopping districts, a variety of usable outdoor spaces are carefully interspersed with businesses, housing, and civic buildings. Businesses benefit from pedestrian activity, and this may be the greatest incentive for developers to incorporate public open spaces into their site plans. Whether an active sidewalk, a large civic plaza, or a small pocket park, the integration and interconnection of outdoor spaces contribute substantially to making a pedestrian district economically vital.

A series of well-designed and integrated pedestrian facilities will encourage pedestrians to walk, explore, shop, and interact. Secure, attractive, and active spaces also provide focal points in the community. These spaces can be as simple as an expanded sidewalk for outdoor dining, or as complex as a large plaza with public art and entertainment.

All of the design guidelines mentioned previously in this section relate to pedestrian-friendly sites and contribute to creating a broader pedestrian-

A lively mixed use street scene in Corpus Christi, TX
(Provided by Kathleen Kern)

A street with no curbs has been converted into a pedestrian-only space. Trees provide shade.

Successful pedestrian malls have highly programmed spaces and a constant level of pedestrian activity. (Shihmei Barger)

friendly district. Some jurisdictions adopt pedestrian-oriented overlay zones or design guidelines for their special pedestrian districts to encourage pedestrian-friendly design.

Sites and Corridors Used Exclusively by Pedestrians

Pedestrian malls, plazas, and other areas can be developed for either exclusive use by pedestrians or with the intent that pedestrians are the primary user group. These spaces can provide important opportunities to increase pedestrian travel in our communities and enhance the enjoyment of Hawaii's unique features. Since these sites serve high numbers of pedestrians, they are usually designed with the specific needs of pedestrians in mind.

These areas may be developed as part of other public spaces and facilities (parks, plazas, transit stations) that are essential ingredients for making communities pedestrian-friendly.

Exclusive pedestrian areas can support revitalization and economic development if they are lively, friendly settings that attract residents and visitors. However, these areas must be planned and designed carefully to be effective. When areas are closed to motor vehicle traffic altogether, business success in the area can vary. Many pedestrian malls were developed in North American towns and cities in the 1970s. After these areas failed to attract customers, they become inactive and unsuccessful because businesses closed. These malls may not have succeeded because businesses did not get as much exposure to people driving by. (Vehicular traffic and street parking tend to generate more activity, increasing visibility of businesses, and creating a feeling of safety for pedestrians.) Many of these malls were subsequently reopened to motor vehicle traffic.

Some pedestrian malls have been successful, particularly in resort communities and some downtown and suburban shopping districts where there is a high level of constant pedestrian activity. For example, there are successful pedestrian malls in Denver, CO; Boston, MA; Minneapolis, MN; and Burlington, VA, among others. Successful pedestrian malls exhibit common elements such as:

- Shortness in length
- Strong cross-connectivity/visibility from cross corridors
- Appealing, human-scale spaces
- Overhanging tree canopies
- Mixed uses
- Heavily programmed activities (play spaces for children, street performers, and vendors)
- Incorporation of public transit
- Pedestrian scale lighting
- Public art, water features, colorful treatments, and other attractive elements

Today, many urban designers suggest that pedestrian-friendly multimodal streets are the best solutions for vibrant downtowns and commercial areas. Pedestrian design features and traffic calming design strategies to control traffic speeds and volumes can help to create a good pedestrian environment. If the desire is to create a pedestrian-friendly downtown, it is generally better to calm vehicle traffic and improve pedestrian and bicycle conditions throughout the area rather than let high speed and high volume motor vehicle traffic dominate the environment.

Partial or temporary closures of streets for pedestrian use for festivals and special events or during special time periods (e.g. evenings, Saturday markets) are also becoming popular in many downtowns and town centers (see Festival Streets).

When pedestrian malls, corridors, plazas, and other exclusive pedestrian use areas are being considered, the following guidelines should be followed.

- Pedestrian exclusive areas require a critical mass of users. They should be perceived as both a destination and a pedestrian thoroughfare that connects a diversity of active uses.
- Encourage adjacent development that attracts 24/7 activity (residential, shops/retail, education, employment, entertainment, etc.). Mix uses as appropriate. For example, apartments and offices can often be located over shops.
- Create places where pedestrian activity thrives by introducing special events,

This shared street in Cambridge,MA is closed to vehicular traffic for the majority of the day.

Temporary street closures can also create new spaces for play. (Allie Gerlach/SDOT)

A map engraved into the sidewalk can provide wayfinding, education, and artistic interest.

Wayfinding elements are important in pedestrian-only spaces.

entertainment, music, concessions, seating, and outdoor cafes. Use the space as a hub for a variety of artistic, cultural, and recreational activities and amenities (street fairs, historic interpretation, markets, play equipment, water features, etc.)

- Create an attractive, pleasant environment, with streetscaping, shade, amenities, pedestrian lighting, public art, and other features. Buildings and street furniture should be pedestrian scale. Avoid or minimize blank building walls or routing pedestrians next to garbage dumpsters.
- Special paving and accents can enhance plazas and pedestrian districts by unifying district identity and providing a clear message to tourists as to where they should walk.
- Wayfinding signage is an important tool in these areas, and can be used both to identify elements within the district and to clearly orient and direct pedestrians.
- Allow motor vehicle access for emergencies, service vehicles, and deliveries. Delivery vehicles can be allowed based on need and during selected time frames (may include unrestricted motor vehicle access during morning hours). It may also be desirable to allow transit vehicles, resident and hotel pick up, or other special vehicle access.
- Maintain high standards for security, cleanliness, and maintenance.

Shared Streets, Festival Streets, and Play Streets

A shared street is a common space shared by pedestrians, bicyclists, and low-speed motor vehicles. These streets go by many names, including “green”, “festival”, and “play” streets. They commonly incorporate sustainable design features. "Shared street" is the term commonly used in English; its origins are based in the concept of a "woonerf," which is a Dutch term loosely meaning "living street." Pedestrians and cyclists have priority (and legal rights, in many European countries) over motorists.

Shared streets are typically narrow streets without curbs and sidewalks. Motorists tend to slow down when trees, planters, parking areas, and other elements are placed along the street.

A festival street is closed to vehicular traffic for a community event in Seattle, WA.

With these types of streets, motorists become the intruders and must travel at very low speeds below 10 mph. This makes a street available for public use that is essentially only intended for local residents or businesses. A shared street can be a residential street, or it can be a street in a commercial area. In the latter case, the streets are often populated by restaurants, cafes, merchant displays, street vendors, and other outdoor commercial uses.

Shared streets can also be designed as green streets, with sustainable and low-impact design, such as stormwater run-off mitigation. Green streets often involve narrowing the roadway to reduce the amount of area devoted to traffic and parking and increase the amount of "open" space for sidewalks and landscaping. They also have connected and well-defined bike and pedestrian paths.

A festival street is designed to be closed to motor vehicle traffic during community festivals and events. The vehicle way is typically designed to be at the same grade as the pedestrian walkway to create a curbless street, where the walkway is delineated with removable bollards. The street can be further enhanced with special paving. Festivals streets are sometimes an extension of an adjacent plaza space.

Play streets are designated residential streets that are closed to vehicular traffic during certain hours, typically late afternoon after school. These streets provide safe areas for children to play without compromising safety. With the assistance of adult volunteers and local police, streets can be barricaded and signed to create these temporary areas.

Consideration must be given to provide access by emergency, sanitation, and other service vehicles (school buses and street sweepers), if needed.

A shared street is generally not appropriate where there is a need to provide nonresident motorists with access to services or through travel.

Access should always favor pedestrians. Other design considerations are listed below.

- Where shared streets cross other streets, the sense of pedestrians as the priority users should carry through the crossing. This may include extremely wide crosswalks, special paving, and pedestrian only crossing signals.
- Where possible, eliminate left-turns and free-right turns at intersections of streets where high volumes of pedestrians cross.
- Drop off and pick up zones for large buses, trolleys, and other touring vehicles are best located on other streets and not on shared streets. (But nearby transit access is desirable.) Any parking or loading areas should be clearly delineated and located to avoid interrupting pedestrian travel and impeding views between pedestrians, bicyclists, and motorists.

Other Resources

The following sources of information are recommended for site design for pedestrians.

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- Whyte, William H. *City: Rediscovering the Center.* Anchor. 1990.
- Whyte, William H. *The Social Life of Small Urban Spaces.* Project for Public Spaces. 2001.


SLOW DOWN
Safely
NO SPEEDING
CLICK IT or TICKET!
DRIVE safly
CEll PHONES can wait
You Got BraKES USE'EM
HONK 4
EYES on the road!

TOOLBOX SECTION

10

Effective Pedestrian Programs

The six "Es" of effective pedestrian programs are education, enforcement, encouragement, engineering, evaluation, and equity.

EFFECTIVE PEDESTRIAN PROGRAMS

Introduction—the Six "Es"

Planners, designers, and advocates for pedestrians and safe routes to school programs often talk about the six "Es":

- *Education*—Programs and approaches that teach motorists and pedestrians about their responsibilities and traffic rules
- *Enforcement*—Engagement of law enforcement to focus efforts in problem areas and increase community awareness of safety issues
- *Encouragement*—Programs and approaches that develop awareness and build enthusiasm for walking
- *Engineering*—Various tools and approaches to the design of pedestrian facilities and streets to improve conditions for pedestrians, enhance safety, and increase the level of pedestrian travel
- *Evaluation*—Review and analysis of data and information from surveys, walking audits, and other research to evaluate the effectiveness of a pedestrian plan or program; guides future planning and implementation
- *Equity*—Considerations related to the diverse needs of all pedestrians as part of development of programs and plans

  Transportation systems, including specific programs for pedestrians, need to be designed to serve everyone. For example, in communities where English is a second language or where there is limited English proficiency, programs need to provide translation and interpretation services to engage the public.

The other toolbox sections provide design guidelines addressing the "Engineering" component of the six "Es." This toolbox section summarizes important considerations and recommended approaches for the other five "Es."

Effective pedestrian education, encouragement, enforcement, and evaluation programs are all interrelated and multi-faceted. All of these

IN THIS SECTION

- *INTRODUCTION – THE SIX "Es"*
- *EDUCATION*
- *ENFORCEMENT*
- *ENCOURAGEMENT*
- *EVALUATION*
- *EQUITY*
- *OTHER RESOURCES*

Walk Wise Hawaii booth at Auto Show

Walk Wise Hawaii asked over 1,200 seniors to take the Pedestrian Pledge at the 45th Annual Mayor's Recognition Program for Outstanding Senior Citizens

approaches need to be applied together with engineering tools to create the most effective pedestrian system and the best conditions for pedestrians. The "Es" can address specific pedestrian travel and safety issues and can make travelers aware of each others' needs in the right-of-way (reducing modal conflicts between pedestrians, wheelchair users, bicyclists, scooters, segways, skateboarders, and others).

In Hawaii, the six "Es" are being implemented by organizations and government agencies at multiple levels–statewide, county-wide, and locally. Many of the existing programs in Hawaii are summarized and referenced throughout this toolbox section. Some other methods and programs being implemented throughout the United States are highlighted in case study example boxes.

Education

Education and outreach programs and campaigns are powerful tools for changing behavior and improving safety skills. These programs vary as there are major differences in walking abilities, behavioral patterns, and learning capacities of different groups of pedestrians and other street/road users. For example, children have different physical and psychological abilities than adults. Educational programs need to be tailored to specific audiences. They need to include public and targeted campaigns, general skills practice and instruction, and specific training programs for targeted user groups such as various pedestrian groups, motorists, officials and decision makers, property owners, and developers.

Existing education and outreach programs in Hawaii are directed by a variety of government-sponsored and not-for-profit organizations that promote safe walking and non-motorized activities. The programs are mostly education and encouragement-focused, and provide technical resources and staff support to implement the federal, state, and local policies that support pedestrian travel. A few examples of existing education and outreach programs in Hawaii are described in the Statewide Pedestrian Master Plan, as well as in this toolbox section.

Educational Training and Outreach Tools and Strategies

Education and outreach are needed on an ongoing basis to support a healthy pedestrian system. Hawaii already has many active programs and campaigns that work to provide education and outreach related to pedestrians. For local agencies and organizations interested in starting their own education and outreach activities, various types of tools and strategies are summarized below. These types of activities also can support pedestrian enforcement and encouragement efforts.

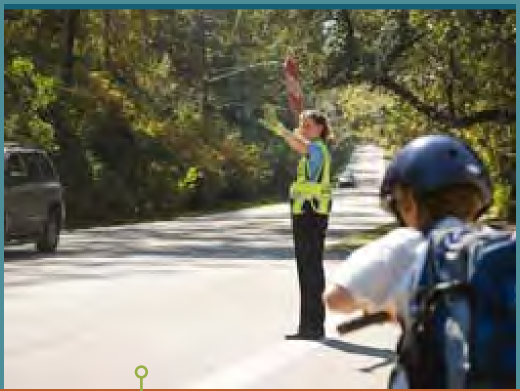
Training programs may be geared toward pedestrians, bicyclists, or motorists, or multiple groups of street/roadway users. The messages behind pedestrian and motorist training programs often focuses on improving personal safety and law abidance. The most effective training programs target a specific community problem. The goals should be specific, measurable, and related to the problems identified.

PUBLIC AWARENESS CAMPAIGNS AND TARGETED CAMPAIGNS

Public awareness campaigns are intermittent (typically time-limited) educational and/or advertising programs that may target specific audiences to achieve beneficial results, such as pedestrians for increased walking or pedestrians and motorists for enhanced safety. For example, a campaign may convey the idea of walking as convenient, pleasant, healthful, and safe.

Public awareness campaigns can serve as a first step for follow-up initiatives and further educational and encouragement programs. They can be delivered via local media such as television, radio, billboards, and posters, as well as non-media methods such as classroom programs, door-to-door canvassing, and partnering with community events. These campaigns can also focus on specific audiences and topics. Targeted campaigns change particular behavior patterns among specific groups. Targeting specific age and ethnic groups has demonstrated effective results throughout the United States. Targeted campaigns have helped pedestrians understand how to interpret signals, how to be more visible at night, and how to be more aware of turning vehicles at intersections. For drivers, these campaigns often focus on yielding to pedestrians and expanding awareness of crosswalk laws.

An example of an existing program in Hawaii would be the "Step it Up" health campaign as



Crossing guards undergo extensive training in Florida's statewide program (FDOT)

Pearl City High School students on Komo Mai Drive in Pearl City campaigning for safe driving (Barry Villamil)

Drive Aloha bumper sticker (Drive Aloha)

Children gain hands-on experience crossing the street in a safe manner in New York's Safety City program (Safety City)

EXHIBIT 10.1 **StreetSmart Billboard in Washington DC Metro Area** (StreetSmart)

described on the ***Healthy Hawaii Initiative*** website. Many other examples exist throughout the United States, including the StreetSmart campaign in the Washington DC metro area. See Exhibit 10.1 for a StreetSmart billboard.

PUBLIC SERVICE ANNOUNCEMENTS (PSAS)

PSAs are non-commercial broadcasts on radio, internet, or television targeted to achieve a public good. Most commonly, they address public health and safety issues, such as safe walking or driving behavior. An example of an existing program in Hawaii would be the ***Drive Aloha*** announcements and jingle. PSAs in other cities, such as those offered in Seattle to promote pedestrian safety, are also examples.

PARTNERSHIPS

Partnerships targeting specific groups are common and often utilize intermediaries who regularly interact with the target group. Hawaii's programs include such partnerships between government organizations, non-profits, and universities.

ONE-TIME INSTRUCTION

Pedestrian safety education can often be included as part of a larger one-time event such as senior citizen health fairs, neighborhood open houses, and transportation fairs at employment sites. As an example, the ***Walk Wise Hawaii*** program conducts educational outreach in the community through its speakers bureau.

ON-DEMAND TRAINING AND MATERIALS

This type of training is typically included within broader design-related exercises. Example training includes the Safe Routes to School National Course, the National Center for Walking and Biking's Walkable Community Workshop, and the Hawaii LTAP (Local Technical Assistance Program) workshops that are specific to engineers and designers.

Additional information:

Safe Routes to School National Course website

Walkable Community Workshop website

Hawaii LTAP Workshops website

Refer to Toolbox Section 8—Children and School Zones for more information about Safe Routes to School, including recent changes in federal legislation. (See pages 8-9 and 8-10.)

SKILLS PRACTICE

Skills practice programs often include multiple sessions and involve lectures, videos, and on-street simulation exercises held under controlled conditions. Defensive walking and street crossing workshops for children and older adults are other examples. Children's programs often feature skills-related games and contests. New York's Safety City program is one such example (see Case Study sidebar). A local example of bicycle skills practice would be the Hawaii Bicycling League's BikeEd on-bike, on-road bike safety program.

EXHIBIT 10.2 Street Sign for Safety City Program (Safety City)

HOW-TO GUIDES

How-to guides are geared to the public and developed by experts and can cover nearly any topic such as: assessing walking conditions, using new transportation modes, and educating decision-makers about pedestrian policies.

TRAINING PROGRAMS FOR OFFICIALS AND DECISION MAKERS

Messages to officials and decision makers focus

CASE STUDY

SAFETY CITY: A PROGRAM FOR NEW YORK CITY'S SCHOOL CHILDREN

In New York City, motor vehicle crashes are the leading cause of preventable deaths of children between the ages of 5 and 14 years old. This program uses a simulated New York City street and intersection to teach children about traffic safety through first-hand experience. The demonstration has realistic pavement markings, traffic and pedestrian signals, and street signs.

At Safety City's Indoor Learning Center students from community schools take part in self-esteem building and safe decision-making activities. Teachers reinforce what the students have learned by conducting follow-up activities such as "Safety Deputies." The students share what they have learned by spreading the safety message to their friends, family members, and others in the community. See Exhibit 10.2.

Since 1990, when the first Safety City opened at Public School 92 in Central Harlem, thousands of children have participated in the program, and the number of children admitted to the Harlem Hospital for motor vehicle-related injuries has reduced by 50 percent.

CASE STUDY

FLORIDA SCHOOL CROSSING GUARD TRAINING PROGRAM

The Florida School Crossing Guard Training Program was the first statewide training course of its type in the United States. It is overseen by the Florida Department of Transportation. The program trains and certifies local school crossing guard trainers, who in turn train school crossing guards in a free two-day training course. Prospective trainers must pass written tests (minimum score of 85 percent) and a practical training skill exam with all satisfactory marks. Crossing guards must pass with a minimum 75 percent score. Annual retraining is required to continue as a guard.

Statewide SRTS funds have been used to completely update the Crossing Guard curriculum, create a crossing guard website for local trainers and the administrator to communicate through, and develop a data base to document the training of trainers and guards. To reach a broader base, a new training video and an online training course are available.

Additional information:
Florida School Crossing Guard Training Program website

on encouraging stronger support for policies, programs, and facilities that promote safe walking. Training topics can be developed for the following groups: transportation officials, city/state employees/staff, magistrates/hearing examiners, safety officers, field inspectors, and design professionals. Key messages:

- Walking is the most basic form of transportation and is an integral part of the transportation system.
- Good pedestrian presence indicates a community's health and vitality.
- Designing a safe, convenient, and comfortable walking environment requires planning, careful engineering, attention to detail, and ongoing maintenance and care.
- Physical improvements must go hand-in-hand with education, land use controls, legal changes, encouragement, enforcement, and evaluation. City and county ordinances that require construction of sidewalks are an example.
- Funding programs and political support for programs and infrastructure that support walking are crucial.

TRAINING PROGRAMS FOR PROPERTY OWNERS AND DEVELOPERS

Training programs that focus on property owners' and developers' rights and responsibilities, particularly related to the public right-of-way, can be helpful. These types of programs can also educate owners and developers about the permitting and inspection processes for new developments. Training topics may be developed for the following groups: developers, residential property owners, business owners, and construction managers/contractors. Specifically, training topics such as property owner responsibilities, sidewalk repair "how-to" information, sidewalk permitting processes, inspection processes, and preservation of the pedestrian right-of-way during construction can be covered in information distributed with permit applications, displayed online, or via educational mailings or contractor training classes.

Exhibit 10.3 lists a variety of outreach methods successfully used in training programs. Exhibit 10.4 lists training program examples targeted to a diversity of audiences, including programs in Hawaii as well as other locations throughout the United States.

EXHIBIT 10.3 Successful Outreach Methods for Training Programs

Here are a few outreach methods that can be used in training programs. These also can be targeted to specific audiences and groups:

Property Owner Brochures—For example, lists of recommended contractors and arborists and instructions for sidewalk repair can help ensure quality work within the public right-of-way.

Wayfinding Displays and Maps—Online information, walking maps, informational kiosks, and signs (in an accessible format) can be targeted to tourists as well as locals.

Drivers Licensing Exam—Driving exams can be tailored to include additional questions related to pedestrians (such as crosswalk laws). Requiring driver's license applicants to demonstrate knowledge of their responsibilities in regard to pedestrians can make them more likely to observe traffic rules that affect pedestrians.

Traffic 101 Classes—Classes through community colleges, community centers (YMCAs), volunteer organizations, schools, and other venues can reinforce the importance of obeying the speed limit, and spotting and stopping for pedestrians in crosswalks.

Safety CDs/DVDs—Specifically developed multimedia programs can reach specific audiences that learn best visually and aurally. Programs can be produced in multiple languages, as well as with captioning for the hearing impaired.

Comics and Coloring Books—These types of materials can attract and hold children's attention and present walking as a fun activity, while also teaching about safe pedestrian behvavior.

Surveys—Surveys give pedestrians a voice and also can help to determine their needs and preferences. The way information and questions in surveys are structured can help to train and educate the respondents. Survey results can be used to guide public policy and prioritize pedestrian improvements.

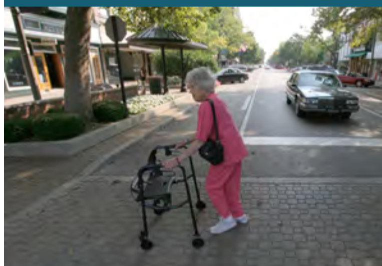
New Resident Mailings—Welcome packets can alert residents to the benefits of walking, as well as good pedestrian behavior. Packets can include maps, coupons, and pamphlets outlining pedestrian rules and regulations.

EXHIBIT 10.4 ***Examples of Training Programs***

	SUGGESTED TRAINING ACTIVITIES AND TOPICS TO BE ADDRESSED	EXISTING EXAMPLE PROGRAMS
DRIVERS		
	Training that encourages drivers to: • Be alert—watch for pedestrians at all times • Be responsible—stop for pedestrians at crossings • Be patient—drive the speed limit and avoid aggressive maneuvers Training can also be geared to special needs drivers, such as: • Senior drivers who exhibit slower reaction times, poorer night vision, reduced depth perception, and reduced visual contrast sensitivity	• Drive Wise • Drive Aloha • Share the Road with Aloha Campaign
BICYCLISTS		
	Training that addresses common bicycling issues associated with pedestrians: • Riding against traffic or in unsafe places • Ignoring traffic signals and signs • Riding unpredictably and failing to sign before turning • Passing pedestrians unsafely • Failing to yield to pedestrians when turning	• Move with Aloha Campaign (University of Hawaii Manoa) • BikeEd (Hawaii Bicycle League) • "Ride Aloha" slogan for Hawaii Bicycling League • Bike Smart (Seattle)
MOTORCYCLE AND SCOOTER RIDERS		
	Training geared to motorcycle and scooter riders to expand awareness about pedestrians: • Training classes, such as those offered by the National Highway Traffic Safety Administration • Distributing literature at the register in cycle or scooter shops might prove to be an effective educational outreach method	• National Highway Traffic Safety Administration training classes
ALL PEDESTRIANS		
	Training and outreach programs applicable to all pedestrians (also see programs for specific pedestrian target audiences in this table).	• Walk Wise Hawaii • Healthy Hawaii Initiative (Start Living Healthy Program) • Walkable Communities programs

Note: See links to websites for programs listed at the end of this section.

EXHIBIT 10.4, Continued ***Examples of Training Programs***

	SUGGESTED TRAINING ACTIVITIES AND TOPICS TO BE ADDRESSED	EXISTING EXAMPLE PROGRAMS
EMPLOYEES AND COMMUTERS		
	Training to expand awareness that pedestrian, bicycle, and transit travel can help reduce the traffic congestion and carbon footprint associated with single occupant motor vehicles, through: • Campaigns and educational messages that encourage commuters to walk, bicycle, use transit or vanpool/carpool instead of driving	• Walk Wise Hawaii • Walk Bike Ride Challenge (Seattle)
PEOPLE WITH DISABILITIES		
	Training targeted to the special needs of people with disabilities, such as: • Enhancing safety through brochures that help pedestrians with disabilities understand how to navigate intersections, including Accessible Pedestrian Signal (APS) systems • Providing educational materials in an alternative format for pedestrians who are deaf, hard of hearing, blind, or have low vision. (i.e. captioning for video or audio programs to interpret printed materials).	
TOURISTS		
	"Passive" training (including other languages) that can effectively reach tourists in the areas they frequent, such as: • Posters or brochures displayed/circulated at hotels and destinations that educate about pedestrian crosswalk laws and pedestrian rights and responsibilities • Pamphlets that make tourists aware of travel options and walking directions to popular destinations (which could draw more tourists onto sidewalks) • Articles that promote car-free, walking vacations for environmental and health benefits	• Walk Wise Hawaii
RECREATIONAL TRAIL USERS/ADVOCATES		
	Training and outreach focused on recreational trails, including: • The need for trails • Trail use etiquette • Conservation messages • Trail design parameters	• Waimea Trails and Greenways • People's Advocacy for Trails Hawaii (PATH) • Na Ala Hele Trails and Access Program • Ho Aloha Aina (Friends of the Land)

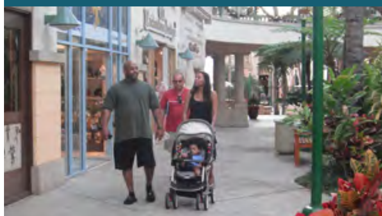
Note: See links to websites for programs listed at the end of this section.

EXHIBIT 10.4, Continued ***Examples of Training Programs***

	SUGGESTED TRAINING ACTIVITIES AND TOPICS TO BE ADDRESSED	EXISTING EXAMPLE PROGRAMS
	CHILDREN	
	Training that builds children/student awareness of: • Pedestrian safety skills • Personal safety • Health and environment benefits of walking	• PedEd Hawaii • Safe Routes to School • Key messages for children online guide • Walk Wise Hawaii • Hawaii's Opportunity for Active Living (HO'ALA)
	YOUTH AND TEENS	
	Training geared to youths and teens with materials that are: • Technologically driven and visually interesting; potential topics include safe walking and driving habits (i.e., using crosswalks, waiting for signals, brightly colored clothing for visibility at night, stopping for pedestrians in crosswalks, etc.) and navigational techniques for getting to destinations via walking and/or transit *Note: This age group is often overlooked in educational materials that address pedestrian behavior.*	• Social Media campaigns—$248 Challenge (Seattle)
	COLLEGE STUDENTS	
	Training focused on college students, presented through: • Special programs or brochures distributed on campus *Note: college students are unique in their needs and the methods available to educate them. Programs need to focus on campus-based population and recognize seasonal calendar/intermittent student population.*	• Move with Aloha—UH Manoa
	ADULTS	
	Active training programs through community services, as well as passive training that is available more broadly, such as: • Pedestrian safety messages in public relations efforts (i.e., news releases, fact sheets for local officials, press events)	• Walk Wise Hawaii • Healthy Hawaii Initiative

Note: See links to websites for programs listed at the end of this section.

EXHIBIT 10.4, Continued ***Examples of Training Programs***

	SUGGESTED TRAINING ACTIVITIES AND TOPICS TO BE ADDRESSED	EXISTING EXAMPLE PROGRAMS
OLDER ADULTS		
	Training geared to the needs of older adults that builds awareness of: • Threats presented by turning cars • Tips for safely crossing intersections	• Walk Wise Hawaii • Safe Routes for Seniors (Hendersonville, NC)—presentations at public library followed by educational walk.
NEW PARENTS		
	Training targeted to new parents, such as: • Educational messages focused on ways to keep children safe, navigating busy streets with a stroller, and driving safely with often distracting children in the car • Programs that target new-parent groups through child care centers and pediatric offices	
ALCOHOL AND DRUG CONSUMERS		
	Training specifically geared to reach this audience through: • Educational materials (posters, brochures, etc.) at clinics, rehabilitation centers, etc. • Emphasis on the dangers of driving while under the influence and programs that assist by providing free rides	• Anna's Ride Home—free taxi rides home from bars (Seattle)
ENGINEERS/DESIGNERS		
	Training focused on engineering and design approaches to: • Improve pedestrian accessibility, mobility, and safety • Complete Streets • Other related transportation topics	• Hawaii Local Technical Assistance Program (LTAP) • Complete Streets Coalition (Technical Assistance via Smart Growth America)

Note: See links to websites for programs listed at the end of this section.

Enforcement

Enforcement programs can be used to help change the behavior of motorists, pedestrians, bicyclists, and transit patrons and to educate them about applicable traffic laws. Enforcement alone is not likely to have a long-term effect and is best used in combination with education and other tools. Enforcement strategies typically involve city officials and staff, drivers, bicyclists, and pedestrians working in conjunction with law enforcement officers.

Targeted Behaviors

Typical types of unsafe behaviors that can be targeted through enforcement are summarized in Exhibit 10.5.

Enforcement Campaigns and Programs

The following are examples of enforcement campaigns and programs. These activities may be similar to education campaigns and programs, but more focused on messages and approaches to improve pedestrian safety and the walking environment through enforcement of current laws, codes, and regulations.

EXHIBIT 10.5 ***Behaviors that Can Be Addressed through Enforcement***

UNSAFE DRIVER BEHAVIORS
Speeding on residential streets and through school zones. (Speed is directly related to pedestrian crash frequency and severity.)
Failing to yield to pedestrians, especially in crosswalks. (The law requires drivers to stop for pedestrians in crosswalks. It is a law that is often ignored.)
Running red lights or stop signs.
Passing stopped vehicles (such as school buses).
Parking or stopping in crosswalks.
Talking, texting, or web browsing while driving.

UNSAFE PEDESTRIAN BEHAVIORS
Failing to look left, right, and left again before crossing the street.
Crossing a street at an undesirable location.
Darting out between parked motor vehicles.
Wearing dark clothes when there is poor lighting.
Talking, texting, or web browsing while walking.

UNSAFE BICYCLIST BEHAVIORS
Riding into traffic without looking left, right, and left again.
Riding against traffic instead of with the traffic flow.
Turning left without looking and signaling.
Failing to obey traffic signs and signals.
Failing to yield for pedestrians.
Failing to cede the right-of-way to pedestrians on a sidewalk or in a crosswalk.
Riding out from a driveway or between parked vehicles.
Failing to wear a bike helmet

PUBLIC SAFETY CAMPAIGNS BY LAW ENFORCEMENT OFFICERS

These campaigns may target any of the user groups, but are most often targeted at drivers. A public safety campaign reminds the audience of the potential negative effects of certain behaviors. Typical campaigns call attention to vulnerable populations such as children crossing the street, and encourage drivers to think about the consequences of failing to yield to crossing pedestrians. Since 2006, the Honolulu Police Department's undercover jaywalking sting operation has issued thousands of citations.

VANDALISM AND GRAFFITI "REPORT" PROGRAM

Defamation of private property has been shown to have a snowball effect and decrease neighborhood livability and property values. Pedestrians are less likely to walk in areas that appear blighted and vandalized. Some cities have graffiti nuisance ordinances that require property owners to remove graffiti in a timely manner. (Paint and marker ink are more difficult to remove over time.) For example, in Seattle, residents can use an online report form, or call the Graffiti Report Line.

EXHIBIT 10.6 *The multicity Eye to Eye campaign aims to foster awarness and respect on shared paths and roadways.* *(Bicycle Transportation Alliance, Portland, Oregon)*

EXHIBIT 10.7 *Public Safety Campaign*

A pedestrian wearing dark clothing at night prepares to illegally cross the street (flickr.com/noise64)

A cyclist creates a hazardous situation by crossing against the light (Margaret Gibbs)

EXHIBIT 10.8 *Online graffiti report forms allow the public to take ownership of their streets and neighborhoods. (City of Seattle)*

SEATTLE.GOV

Seattle Public Utilities

Report Graffiti Form

Please fill out the form as completely as possible. When a reporter of graffiti requests anonymity, it is the policy of the City of Seattle to keep all identifying information confidential.

* Indicates required fields. Information is only used for follow-up on the report. If you would like a call back, please tell us in the comment box below.

Contact Information:

Name*

Street address

Zip Code

Day Phone (with area code) * ext.

Alternate Phone (with area code) ext.

E-mail

☐ Please do not disclose any information revealing my identity

Graffiti vandalism information:

Location of Graffiti:*

Please enter exact physical address or closest available address. Include the specific location of violation such as: fence, alley, pole, control box, etc.

Description of Graffiti:*

TRAFFIC COMPLAINT HOTLINE

This program allows a local community to report traffic problems directly to law enforcement. Law enforcement can then identify issues quickly, and the public takes ownership and is engaged.

AGGRESSIVE DRIVING APPREHENSION TEAM

The County of Hawaii developed a *Curbing Aggressive Driving Plan*, which includes provisions to address two target groups: commuters traveling long distances along highways and young drivers. The plan includes a variety of measures including short-term and long-term enforcement, engineering, and educational program elements.

The 2011 *State Highway Safety Plan for Hawaii* calls for *"funds to be used to pay overtime to officers to enforce speed related laws and conduct both high visibility checkpoints and stealth projects targeting aggressive driving. A minimum of 50 high visibility checkpoints will be conducted. Crash and fatal data will be used to identify problem areas."*

Other Enforcement Technologies and Practices

There are a number of other enforcement technologies and practices that can be used to enforce good driving behavior. Some of these are summarized below. These are typically initiated by local law enforcement, but can also be sponsored through neighborhood traffic calming programs or other methods.

SPEED TRAILERS

- Portable speed trailers display drivers' real-time speeds compared to the speed limit.
- Trailers have been shown to reduce speeds and crashes and appear to be at least as effective as speed cameras while also being more cost-effective (according to the US Department of Justice).
- Some trailers are able to collect traffic count data and speed data throughout the day, thereby identifying the traffic time periods when more enforcement is needed.
- These are best used in residential areas and can be used in conjunction with neighborhood speed watch programs or other safety education.
- Speed trailers should be placed in locations where they do not block pedestrians, bicyclists, or motor vehicle traffic.
- Police should be encouraged to conduct speed enforcement downstream from the display board to increase the effectiveness of the device and educate motorists of some of the consequences of speeding.

ACTIVE SPEED MONITORS

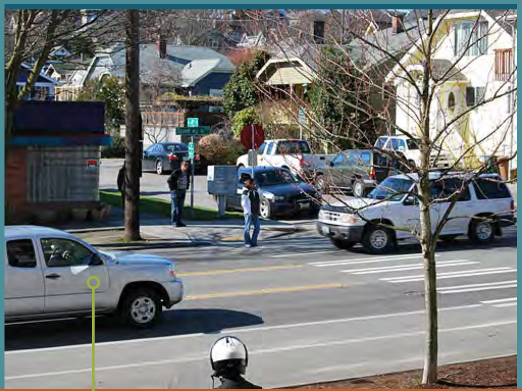
- Also known as "Know Your Speed" signs, these are permanent devices that make drivers aware of their speeds compared to the speed limit.
- They alert drivers of the need to slow down in certain areas, especially near schools and parks.
- Some active speed monitors are solar-powered.

EMPHASIS PATROLS OR PEDESTRIAN "DECOY" OPERATIONS

- Police officers in highly visible civilian clothes pose as pedestrians crossing the street while other hidden officers observe their attempts.
- If a driver violates safe crossing rules by failing to yield to the pedestrian, the hidden officers approach the violators and may issue citations.

An example of a high-visibility aggressive driving enforcement. (Pennsylvania Department of Transportation)

Speed trailer (Seattle Department of Transportation - SDOT)



Emphasis patrol
(SDOT)

Speed monitor
(SDOT)

SPEED ENFORCEMENT FOCUS ACTIVITIES

- Police cars with radar guns are slightly hidden to catch and ticket drivers who are speeding.
- Officers typically wait in the same place for several days in a row and return periodically to the area to monitor speeding activity.

CAMERA RADAR ENFORCEMENT/ RED LIGHT CAMERAS

- Automated photo speed enforcement takes real-time photos of traffic to record vehicle speeds and behaviors.
- Citations are typically issued through the mail to the registered owner of the vehicle.
- Many cities have red light camera programs in place that have been effective in reducing speeds (fewer drivers running red lights and a decline in crashes).
- This practice is controversial, but it has raised awareness about speeding and consequences. The community needs to understand that the goal of this enforcement tool is to improve safety and not to invade privacy or generate revenue. This is an example of why education and enforcement programs working together in concert can be more effective.

Exhibit 10.9, Typical Enforcement Tools, displays the pros and cons of some of the aforementioned technologies and practices in traffic enforcement.

Additional Law Enforcement Methods: Warnings and Citations

Additional enforcement actions and tools include penalties for violating codes, laws, and/or regulations. Regardless of the methods used, enforcement activities require follow-up to maintain their effectiveness. Before-and-after study results will help decide next steps. Even with initial success, communities need to repeat enforcement efforts periodically in order to sustain improvements in driver behavior.

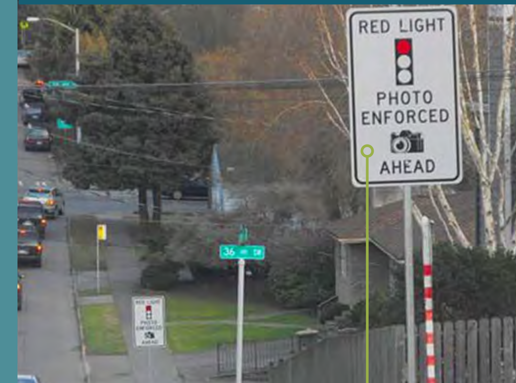
FOR MOTORISTS

Failure to Yield Citations

Drivers are required to stop for or yield to pedestrians crossing the street in a crosswalk. Yet this law is often violated in Hawaii and elsewhere. Consequently, a combination of short- and long-term, on-going police enforcement measures can be undertaken.

EXHIBIT 10.9 Typical Enforcement Tools

DEFINITION	PROS	CONS
SPEED TRAILER		
Portable trailer that displays drivers' speeds	• Provides immediate feedback • Does not require officer to be present–relatively low cost • Can be moved to varying locations	• Not a substitute for permanent action
ACTIVE SPEED MONITOR		
Permanent device that displays drivers' speeds	• Provides immediate feedback • Does not require officer to be present	• Cannot be moved around easily
EMPHASIS PATROLS, PEDESTRIAN STINGS OR PEDESTRIAN "DECOY" OPERATIONS		
Police officers catch and fine pedestrian violators/jaywalkers. In decoy operations, officers pose as pedestrians to identify drivers who fail to stop for crossing pedestrians	• Can be high visibility through media coverage • Can quickly identify offenders • Poses no threat to actual pedestrians	• Requires police resources, which may include overtime pay • Needs to be done at regular intervals
CAMERA RADAR ENFORCEMENT / RED LIGHT CAMERAS		
Mobile cameras connected to speed measuring devices or to red lights record violations and citations or warnings can be issued *(Note: Current laws in Hawaii, do not allow citations for moving violations to be issued via mail.)*	• Flexible, does not require presence of officer • An effective deterrent as would-be offenders do not know when camera is operating • An effective part of an overall traffic safety program	• Does not replace traditional approach to traffic enforcement. • Equipment costs • Requires public and political support to be effective • Can lead to reaction without effective public education efforts • Requires input from a variety of sources, such as courts, prosecutors, and community groups for maximum effectiveness



Red light sign (SDOT)

Camera radar

Jaywalkers (SDOT)

Patrol car

Police enforcement is most effective when it is part of a public safety information campaign.

FOR PEDESTRIANS

Jaywalking Citations

Failing to obey a 'DON'T WALK' signal or crossing illegally can warrant a jaywalking citation. These citations are often issued as part of "emphasis patrols" where a number of officers target a particular intersection for enforcement. However, the overall effectiveness of jaywalking citations is questionable as it has not yet been evaluated.

"REPEAT OFFENDER" PROGRAM

- This program is used to enforce speed limits, parking restrictions, or yielding to pedestrians in crosswalks. The cost of fines and tickets can be increased as motorists continue to violate the same law/restriction.
- The goal of the program is to "force" motorists to recognize that their behavior patterns must change in order to avoid increasingly strict penalties.
- This program requires that law enforcement officials have appropriate technology to identify repeat offenders (such as a searchable database).

PROGRESSIVE TICKETING

This method introduces ticketing through a three-stage process. The process provides time to build support for the program, as well as time for offenders to change their behaviors.

1. ***Educating***—Establish community awareness of the problem. Raising awareness will change some behaviors and create public support for enforcement efforts.
2. ***Warning***—Announce what action will be taken and why. Give the public time to change behaviors before ticketing starts. Official warnings via multimedia can serve as reminders.
3. ***Ticketing***—After warning time expires, hold a press conference announcing when and where the police operations will occur. Officers issue tickets to offenders.

DOUBLING FINES IN SCHOOL ZONES

In school zones, there is typically strict enforcement of speed laws. Some jurisdictions employ a zero tolerance policy for speeders in school zones and a doubling (or other increase) in fines for violators.

TICKETS FOR RIGHT-OF-WAY OBSTRUCTIONS

- Citations for right-of-way obstructions (e.g., sandwich boards signs, private construction activities that overlap onto sidewalks, or tree/vegetation overgrowth) are used in some municipalities.
- A drawback to this method of enforcement is the time required to identify violations and re-inspect (and re-ticket, if necessary) to ensure compliance.

TRIPPING HAZARD WARNINGS

- In San Francisco, the city requires property owners to eliminate tripping hazards (such as buckled or cracked sidewalks, or extruded tree roots) in the right-of-way adjacent to their property.
- The city flags violations, posts a notice, and reinspects the site after 30 days to ensure compliance.
- Requires staff time in identifying hazards and monitoring repairs.

EXAMPLES OF FINES & TICKETS IN HAWAII (2011)

- *Honolulu: $137 and court citation for drivers who don't stop for pedestrians*
- *Statewide: HRS291-C72 mandates $150 ticket for first time offense to motorists who don't stop for pedestrians, with increasing fines for repeat offenses*
- *Honolulu: $130 fine to pedestrians who jaywalk*
- *Statewide: HRS291C-73 mandates $100 fine for jaywalking.*

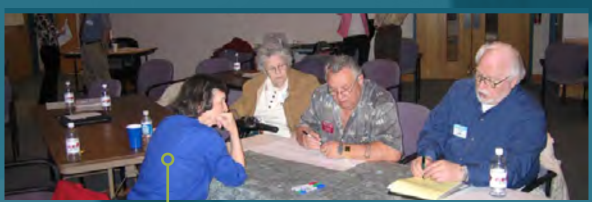
Police ticketing (SDOT)

CASE STUDY

WALK WISE, DRIVE SMART: STEPPING UP TO A MORE WALKABLE HENDERSONVILLE

This neighborhood-based project was part of the Henderson County Livable and Senior Friendly Community Initiative. It was built upon established community relationships and used community input to guide improvements to the walkability of Hendersonville. The project successfully engaged community residents in assessing the safety of their neighborhoods through a process of interviews, neighborhood meetings and environmental audits in ten neighborhoods with a high proportion of older adults.

This project included a high degree of interdisciplinary collaboration between public health professionals, urban planners, transportation professionals, developers, architects and other relevant parties. It combined educational, encouragement, enforcement, and environmental activities to create a safer and more inviting walking community.



Broad action concepts and specific activities were as follows:

- *Education—Educated the professional and lay community about safety and walkability factors; broadly share information about pedestrian safety. Specific activities include: Safe Routes for Seniors pilot course followed by an environmental audit walk; bright yellow "Slow Down! Neighbors Walking" yard signs distributed and posted; and raffle ticket postcards given to motorists who stopped for pedestrians at mid-block crossings – winners received prizes from local merchants.*
- *Enforcement support—Discouraged motorist actions that endanger pedestrians and monitored unsafe areas. Specific activities: police chief was part of local advisory committee and speed trailer was used in project neighborhoods.*
- *Environmental changes—Made sidewalk and crosswalk improvements. Specific activities: used interviews and audits to shape community action; repaired sidewalks from tripping hazards; stenciled 'apple logos' wayfinding arrows on the sidewalk to mark improved routes; and added pedestrian mid-block crossing signs.*
- *Encouragement—Worked with partners to increase walking in the community. Specific activities: raffle tickets were handed out to walkers on the neighborhood routes; winners of the prizes were photographed for the local newspaper; group walks were sponsored and publicized on a list serve and local newspaper; and a series of safe walking routes maps were developed and printed on enlarged easy-to-carry postcards.*

For more details about this project go to:
Walk Wise Materials
Walk Wise Final Report pdf

Safe Routes for Seniors Workshop (Walk Wise Drive Smart - WWDS Hendersonville)

Walk Wise Drive Smart kickoff event (WWDS Hendersonville)

FeetFirst Audit
(WWDS Hendersonville)

REMINDERS TO CLEAR SIDEWALKS

- A friendlier approach than tickets and warnings is the distribution of reminders to neighbors about ordinances governing right-of-way obstructions.
- An example of this would be a leaflet to a property owner with a friendly message to remove their garbage can from the sidewalk.
- The City and County of Honolulu has ordinances that regulate sidewalk obstructions such as the placement and use of signs in public sidewalk areas. Hawaii County has a similar ordinance.

Community-Based Strategies

In addition to law enforcement activities, community members can use the following tools to address neighborhood concerns and assist law enforcement.

COMMUNITY MONITORING

- Neighborhood speed watch programs encourage citizens to take an active role in changing driving behavior in their neighborhood by helping raise public awareness. These programs can be a good first step before considering other traffic control devies. (See Exhibit 10.10.)
- As one example, the Seattle Department of Transportation (SDOT) loans neighborhood representatives a radar gun to record speeds and identify chronic speeders. The City sends letters to drivers traveling more than 30 mph.

PACE CAR PROGRAM

- The Pace Car program is a traffic calming approach that depends on residents to set examples as good drivers. (See Exhibit 10.11.)
- Pace Cars can serve as a “mobile speed bump.”
- In Northampton, MA participants sign a pledge to drive within the speed limit; obey all traffic regulations; share the road with pedestrians, bicyclists, and drivers; and walk, bike, bus, or carpool whenever possible. They are identified by a Pace Car sticker affixed to their rear window.

Infrastructure Changes

Some types of enforcement-related infrastructure changes that can affect driver and pedestrian behavior are summarized as follows.

EXHIBIT 10.10 *Neighborhood Speed Watch Sign*
(SDOT)

EXHIBIT 10.11 *Pace Car Sign*
(Northhampton, MA)

STRIPING AND PAINTING

- Used to indicate both where an action is permitted or should take place (e.g., crosswalks, stop bars) and where an action is prohibited (e.g., no parking zones, bus stops).
- Provides clarity, but overuse is a concern for some.

SIGNAGE

- Examples include: No Parking, Parking Restrictions, Posted Speed Limits, No Right on Red, and Drug Free Zones.
- Traffic signs can be either regulatory, warning, or guide signs. Regulatory signs, such as STOP, YIELD, or turn restrictions require certain driver actions subject to enforcement.
- Guide signs provide helpful information, such as directions to locations, especially to motorists and pedestrians who are unfamiliar with the area.
- Examples of signs that may help pedestrians include warning signs for motorists, warning signs for pedestrians, pedestrian push button signs, NO TURN ON RED signs, and guide signs.
- Advance pedestrian warning signs should be used where pedestrian crossings may not be expected by motorists, especially if there is a high number of motorists who are unfamiliar with the area.
- A new, brighter fluorescent yellow/green (FYG) color is allowed for use in pedestrian, bicycle, and school warning signs per the Manual on Uniform Traffic Control Devices.
- All signs should be periodically checked to make sure that they are in good condition, free from graffiti, reflective at night, and continue to serve a purpose.

PARKING RESTRICTION SIGNS

On-street parking can be beneficial to pedestrians. It provides a buffer between the sidewalk and moving traffic lanes, and it narrows the effective and useable street width, which causes motorists to drive more cautiously. However, parking restrictions are needed under certain conditions as described below.

- “No Parking” signs are installed on a street to increase mobility and safety when roads

Signage at driver's education class (SDOT)

A striped crosswalk in Paia Town, Maui

are narrow, used extensively by emergency vehicles, or the curb lane is used as a travel lane.

- "No Parking" signs are also placed near an intersection to increase sight distance (decreasing the likelihood of a crash).

Refer to the other toolbox sections for additional guidance related to infrastructure improvements that can enhance the pedestrian environment and encourage walking.

Encouragement

Pedestrian encouragement programs help to reinforce educational programs that may already exist. As such, they are similar in nature to educational programs, campaigns, and other activities described previously in this toolbox section. Encouragement tools come in a variety of forms, such as media campaigns and strategies, pedestrian advocacy, walking incentives, wayfinding, walking programs, and events, and can help to encourage walking and promote pedestrian safety.

As previously mentioned under *Enforcement*, a well-designed built environment can not only encourage good behaviour, it can also encourage pedestrian activity and enhance safety. Best practices in planning and design are critical to encourage walking. Pedestrian-friendly design and planning include such elements as destinations, amenities, landscaping, physical improvements, eliminated barriers, and weather protection. See earlier suggestions in this toolbox section, and also refer to Toolbox Sections 1 though 9 for more detailed guidance on best practices planning and design for pedestrians.

Media Campaigns

As with education programs, media campaigns are central to promoting and encouraging walking. They create program awareness, encourage community support, and influence individual action.

Media campaigns can:

- Reach a large audience and convey a variety of messages.
- Encourage behavioral changes via bus billboards, banners, signs, websites, and residential mailings.
- Provide information in all relevant languages and via methods for those who are hearing and/or visually impaired.

EXHIBIT 10.12 *Seattle Pedestrian Masterplan - Brochure in Mandarin Chinese* (SDOT)

EXHIBIT 10.13 *Walk Bike Ride Challenge* (SDOT)

Types of media campaigns include:

- ***Social Marketing and Media***—Highly focused media campaigns that use appropriate social and commercial marketing techniques (YouTube, Facebook, Twitter, etc.) to achieve a social good by effecting specific behavioral changes in targeted populations. Youth and community advocacy groups can share their involvement in traffic safety programs with their peers.

  An example program would be using sports celebrities in Chicago to encourage safe driving. ***Drive Safe, Stop Safe*** website. Also, see the ***$248 Challenge Case Study*** about a recent campaign using social media. (Refer to Exhibits 10.14 and 10.15.)

- ***Public Endorsements***—Via TV and radio spots; direct mail fliers; and magazine and newspaper advertisements.
- ***Public Awareness Campaigns*** (see Education)
- ***Public Service Announcements*** (see Education)
- ***Targeted Campaigns*** (see Education)
- ***Paired Transportation Options***—Allow ways for people to pair walking or biking with transit. Destination-specific bus and station signs encourage this exploration of places. Buses and light rail have bike racks for these multimodal trips.

Other Tools and Strategies

A variety of other tools and strategies can encourage pedestrian activity and safety. Several of these are described on this page and the following pages.

PEDESTRIAN ADVISORY AND ADVOCACY GROUPS

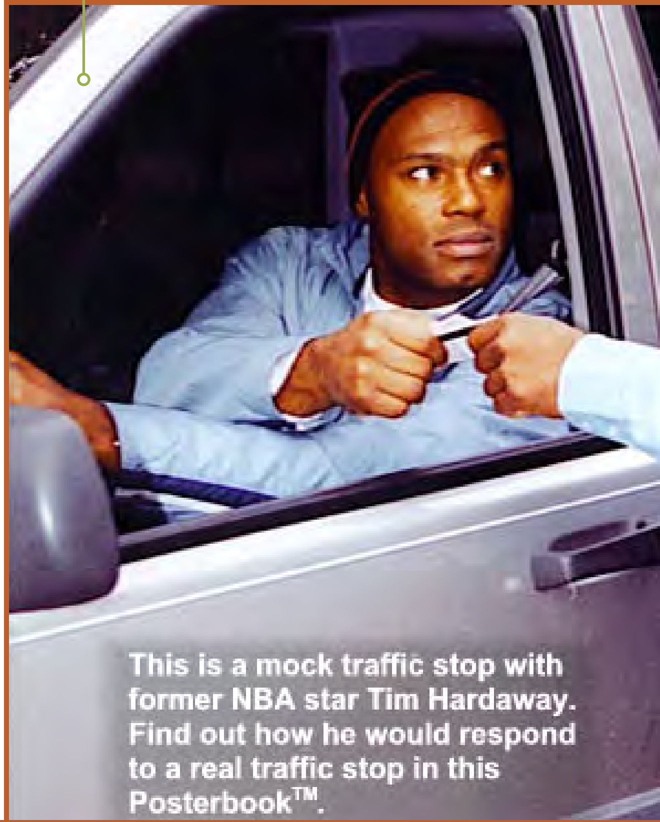
- There are many existing organizations, advisory and advocacy groups, and potential partnerships that promote walking.
- These organizations work to improve the pedestrian environment through lobbying, research, community involvement, and providing information to promote walking.
- Example advisory groups include: ***PATH, AARP, Pedestrian Bicycle Information Center,*** and others.

WALKING INCENTIVES

- Tools include promotions, support, programs, and awards.

Councilmember Nick Licata gives a pedestrian safety public service announcement (Seattle Channel)

Tim Hardaway is featured in this safe driving ad. (Chicago Drive Safe, Stop Safe)



CASE STUDY

$248 CHALLENGE–CONTEST TO TACKLE DISTRACTED DRIVING

The $248 Challenge is a Seattle-based contest to design a billboard or create a video demonstrating the dangers of texting while walking or driving. The contest provides a financial incentive for teens to participate, as well as an opportunity to explain hazardous texting behavior in their own words.

$248 is twice the fine for texting while driving. This project is appealing to teens through the use of social media, as well as an outlet for teens to express their voice in an effective campaign.

The contest was launched by high school students and kicked off with a mock arrest in the school lunch room. Students could vote for the winning billboard or video on the contest's Facebook page.

Three prizes of $248 each were donated by State Farm Insurance.

Additional information:

$248 Challenge Facebook page

SDOT Blog - 248Challenge

- The ***Walk Score*** website calculates the walkability of an address by identifying nearby amenities and destinations.
- Give-aways and promotions such as pedometers are a great motivational tool.
- Participants in Seattle's ***Walk Bike Ride Challenge*** were awarded free bus tickets for cutting down drive-alone trips. The more car trips reduced, the more chances to win.
- Employees can be reimbursed for walking to off-site meetings.
- Other support programs provide walking buddies or a free walking music playlist (specifically targeting teens).

WAYFINDING

- Tools include maps, kiosks, and signs for getting people to key destinations in the neighborhood/community.
- Audio, visual, and tactile techniques can be used to safely guide people to destinations of which they might have been unaware.
- Directional tools can encourage people to walk more frequently and in new places.

EXHIBIT 10.14 Facebook Page for the $248 Challenge
($248 Challenge)

EXHIBIT 10.15 Billboard Entry for the $248 Challenge
($248 Challenge)

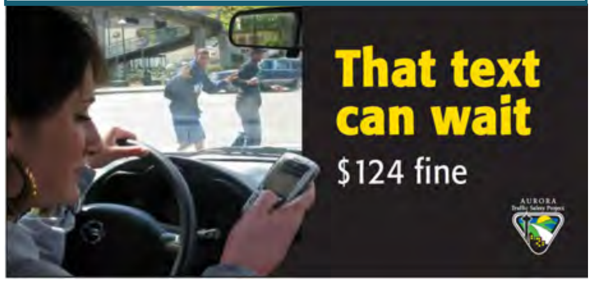


EXHIBIT 10.16 ***National PARK(ing) Day challenges community members to transform vehicular parking spaces in public park spaces for a day.***
(Rebar Group)

One-time events such as health fairs are good venues for promoting walking (SDOT)

- Online tools can tailor directions and walking routes to individual user needs.

WALKING PROGRAMS

- Walking programs are sponsored by various groups and organizations.
- To develop a successful program, organizers should be sure prime objectives are met. Participants may want to socialize, lose weight, or get to school safely.
- Types of walking programs include community-based programs, school-based programs, worksite programs, city-sponsored programs run by Parks and Recreation department that encourage seniors to walk regularly.
- The ***Walking Bus*** is an example in the state of Hawaii. Kauai's "Get on Board" program is another example.
- At "City Walks" events, new walks are selected every week and residents have the opportunity to walk in new places and get to know community members.
- Walks can also be themed around historic neighborhoods or nature trails/bird watching.
- Other example programs include:
  - American Heart Association's ***Fit-Friendly Companies*** program
  - AARP's online walking program for older adults – ***Get Fit on Route 66*** website
  - The American Heart Association's ***Walking to Recovery*** website motivates heart disease and stroke survivors to regain their strength and independence.

EVENTS

- One-time or recurring events are good motivational tools for walking.
- These include health issue walks/runs with a fundraising component (e.g., Aloha Run, March of Dimes Walk, American Heart Association, American Diabetes Association, American Cancer Society).
- Conferences such as Pro Walk Pro Bike connect pedestrian advocates, elected and appointed officials, transportation experts, land-use planners, and many more who wish to create more walkable cities and communities.
- City-wide programs can include events such as: Car Free Days (Seattle), Sunday

BE THE CHANGE YOU WANT TO SEE

Individuals and organizations can initiate change by building awareness about pedestrian needs, promoting walking as a healthy and viable transportation mode, and alerting others to the benefits of walking. Encouraging walking and the development of walkable places fosters healthier, more livable communities.

Parkways (Portland), National PARK(ing) Day, Walk to School Month, and others. (Refer to Exhibit 10.16.)

- Neighborhood block parties bring neighbors together and can be used to promote local pedestrian safety issues and programs

Evaluation

Evaluation involves monitoring and documenting trends through data gathering and analysis. Evaluations can aide in determining the effectiveness of pedestrian related programs, projects, and actions. Evaluation results can also help guide future planning and actions. Agencies and organizations may decide where best to target funding based on the results of evaluation. Evaluation provides an important means for measuring success of pedestrian initiatives, programs, and projects.

Evaluation methods are typically tailored to specific pedestrian plans and programs to measure performance and effectiveness. They also may be targeted toward addressing specific problems, needs, and concerns in a community. The best evaluation programs involve ongoing collection and analysis of data and research to document changes and results before and after implementation of pedestrian projects and programs.

The Statewide Pedestrian Master Plan includes a specific set of performance measures that will be used to evaluate the effectiveness of the plan. As counties, cities, and communities throughout Hawaii develop pedestrian plans and programs, they can adopt their own independent methods of evaluation.

Examples of evaluation methods and measures include:

- Research that documents changes in health issues (increased fitness and reduced rates of obesity and diabetes for example)
- Pedestrian counts to document increases in walking (and transit ridership counts documenting increased transit use)
- Pedestrian surveys also can document increased walking activity, as well as changes in pedestrian behavior and interest in walking, safety improvement needs, methods to encourage more walking, and

other topics (counts and surveys can be conducted by staff or by volunteers)

- Monitoring and review of before and after pedestrian/vehicle crash data, as well as before and after motorist and/or pedestrian violation data
- Review and monitoring of National Household Travel Survey data to document changes in travel behaviors

Some of the most cost effective evaluation programs leverage data sources that are already being collected, such as data compiled by advocacy organizations like the Alliance for Biking and Walking benchmarking reports: ***www.PeoplePoweredMovement.org/benchmarking*** (May 2013). Several government agencies at the federal, state, and local levels collect and monitor data on public health and safety.

Evaluation activities can also include evaluating potential funding sources and implementation opportunities for needed projects. Once projects are implemented, they can be evaluated to demonstrate how they've been successful as a means for leveraging additional funding.

Equity

Equity (also called justice and fairness) related to transportation planning and analysis generally refers to the distribution of impacts (benefits and costs) and whether that distribution is considered appropriate. This involves considering and addressing the diverse needs of communities as part of development of transportation plans, programs, and projects. Equity calls for transportation systems, including specific programs for pedestrians, to be designed to serve everyone.

In general, transportation planning decisions can have significant and diverse equity impacts:

- The quality of transportation available can affect people's opportunities, choices, and quality of life.
- Transportation planning decisions can affect the location and type of development that occurs in an area, and therefore accessibility, land values, and developer profits.
- Transportation facilities, activities, and services can impose various indirect and external costs, such as congestion delay and accident risk, infrastructure costs not funded through user fees, pollution, and undesirable land use impacts.
- Transportation expenditures represent a major share of most household, business and government expenditures. Price structures can significantly affect financial burdens.
- Transportation facilities can require significant amounts of land that is generally exempt from rent and taxes, representing an additional but hidden subsidy of transportation activity.
- Transportation planning decisions can stimulate employment and economic development, which have distributional impacts.

Transportation equity analysis can be difficult because there are several types of equity, various ways to categorize people for equity analysis, numerous impacts to consider, and various ways of measuring these impacts. A particular decision may seem equitable when evaluated one way but inequitable when evaluated another. For example, current planning practices tend to value mobility rather

BikeEd (Hawaii Bicycling League) teaches kids the importance of bicycle safety.

than accessibility, and so favor motorized modes over non-motorized modes, and motorists over non-drivers (Litman 2003; Martens 2006). Planners have fewer tools for measuring non-drivers' travel demand or the benefits of mobility management strategies and more accessible land use.

Equity also relates to how effectively diverse populations in a community are involved and engaged in public projects. For example, in communities where English is a second language or where there is limited English proficiency, programs and projects need to provide translation and interpretation services to engage the public. Special outreach and communications may be needed to communicate and educate the public in these areas about aspects related to pedestrian safety.

When it comes to evaluating community walkability, social equity and health are important considerations. Many segments of the population are disproportionately affected by the health consequences of physical inactivity and poor nutrition. Local governments can address these concerns by planning and designing communities that facilitate healthy lifestyles for all residents. Local managers, department heads, and local government staff can design healthy communities for all residents, regardless of income, race or ethnicity, age, ability, and gender.

The International City/County Management Association published the guide *Active Living and Social Equity: Creating Healthy Communities for All Residents* in 2005. This guide for local governments explains the connections between active living and social equity, provides a toolbox of local government strategies for promoting active living equitably. The guide also highlights notable examples of local initiatives from around the country. A focus on active living and social equity also can serve as a lens through which local governments can address livability needs more generally by removing barriers to economic opportunity, transportation, services and amenities, as well as overall health and safety.

Equity is a consideration that should permeate all planning and design efforts as Hawaii works to implement a statewide transportation system that values and addresses the needs of all pedestrians and all transportation system users.

Other Resources

Below are resources and reference materials from programs and services in Hawaii as well as other places. Many of these were referenced in this toolbox section with hyperlinks. The listed programs' websites are provided as available.

IN HAWAII:

- BikeEd (Hawaii Bicycle League) "Ride Aloha" ***http://www.hbl.org/content/about*** (May 2013).
- Hawaii State Highway Safety Plan, 2011 ***http://hltap.eng.hawaii.edu/shsp/SHSP2007-2012.pdf*** (May 2013).
- Curbing Aggressive Driving Plan ***http://hltap.eng.hawaii.edu/shsp/SHSP2007-2012.pdf*** (May 2013).
- Drive Aloha ***https://ssl.dtric.com/drivealoha/decal.asp*** (May 2013).
- Healthy Hawaii Initiative (Start Living Healthy Program) ***http://www.healthyhawaii.com/about_hhi/about_start_living_healthy/about_the_healthy_hawaii_initiative.htm*** (May 2013).

- Hawaii Local Technical Assistance Program ***http://www4.eng.hawaii.edu/~hltap/*** (May 2013).
- Hawaii LTAP Workshops ***http://hltap.eng.hawaii.edu/*** (May 2013).
- Ho Aloha Aina (Friends of the Land) ***http://www.southmauivolunteers.com/apps/blog*** (May 2013).
- Kauai's Get on Board program ***http://www.getfitkauai.com/schools.html*** (May 2013).
- Move with Aloha Campaign (University of Hawaii Manoa) ***http://www.manoa.hawaii.edu/ovcafo/MoveWithAloha/*** (May 2013).
- Na Ala Hele Trails and Access Program ***http://hawaiitrails.ehawaii.gov/*** (May 2013).
- People's Advocacy for Trails Hawaii (PATH) ***https://pathhawaii.org/*** (May 2013).
- PedEd Hawaii ***http://honaunau.k12.hi.us/honaunau/School_Activities.html*** (May 2013).
- Share the Road with Aloha Campaign ***http://www.myfarmershawaii.com/shareroad*** (May 2013).
- Waimea Trails and Greenways ***http://www.waimeatrails.org/*** (May 2013).
- Walk Wise Hawaii ***https://www.facebook.com/WalkWiseHawaii*** (May 2013).
- Walk Wise Final Report ***http://www.walk-wise.org/WalkWiseFinalReport.web.pdf*** (May 2013).
- Walking Bus ***http://www.walkingschoolbus.org/*** (May 2013).

OTHER PLACES:

- $248 Challenge (Seattle) ***http://www.seattle.gov/transportation/aurorasafety.htm***
- AARP ***http://www.aarp.org/*** (May 2013).
- AARP's online walking program ***http://www.nrpa.org/aarp/*** (May 2013).
- American Heart Association's Fit-Friendly Companies program ***http://www.startwalkingnow.org/start_workplace_fit_friendly.jsp*** (May 2013).
- Anna's Ride Home ***http://www.annasridehome.com/*** (May 2013).
- Bike Smart (Seattle) ***http://www.seattle.gov/transportation/bikesmart.htm*** (May 2013).
- Complete Streets Coalition (Technical Assistance via Smart Growth America) ***http://www.smartgrowthamerica.org/2012/09/19/complete-streets-news-september-2012/*** (May 2013).
- Drive Safe, Stop Safe ***http://www.drivesafestopsafe.com/*** (May 2013).
- Drive Wise ***http://drivewisesafety.com/*** (May 2013).
- Florida School Crossing Guard Training Program ***http://www2.dot.state.fl.us/CrossingGuard/index.aspx*** (May 2013).
- Get Fit on Route 66 ***http://www.hesonline.com/route66*** (May 2013).
- National Center for Bicycling and Walking ***http://www.bikewalk.org/*** (May 2013).
- Pedestrian and Bicycle Information Center ***http://www.pedbikeinfo.org/*** (May 2013).
- Park(ing) Day ***http://www.bikewalk.org/*** (May 2013).

- Safe Routes to School Online Guide ***http://guide.saferoutesinfo.org/education/resources.cfm*** (May 2013).
- Safe Routes to School National Course ***http://www.saferoutesinfo.org/events-and-training/national-course*** (May 2013).
- Safe Streets (New York City) ***http://safestreetsfund.org/*** (May 2013).
- Safety City: A Program for New York City's School Children ***http://www.nyc.gov/html/dot/html/about/safety-city.shtml*** (May 2013).
- Seattle Pedestrian Toolbox ***http://www.seattle.gov/transportation/pedestrian_masterplan/default.htm*** (May 2013).
- Walk Bike Ride Challenge (Seattle) ***http://www.seattle.gov/mayor/walkbikeride/*** (May 2013).
- Walkable Communities Program ***http://www.walkable.org/*** (May 2013).
- Walkable Communities Workshop ***http://www.bikewalk.org/workshopswalkable.php*** (May 2013).
- WalkingInfo.Org: Pedestrian and Bicycle Information Center ***http://www.walkinginfo.org/*** (May 2013).
- Walk Wise Drive Smart (Hendersonville, NC) ***http://www.walk-wise.org/*** (May 2013).
- Walkscore ***http://www.walkscore.com/*** (May 2013).


25
M.P.H.
NEW
DETOUR
USE
CROSSWALK

TOOLBOX SECTION 11

Safety in Work Zones and Maintenance

Pedestrians should feel safe and secure when traveling near work zones, and they need to be provided with clear, designated routes through and around work zones.

SAFETY IN WORK ZONES AND MAINTENANCE

Pedestrian Safety in Work Zones

Pedestrian safety is an important issue in and around work zones. Pedestrians travel at slower speeds than other modes of transportation and are more susceptible to the impacts of access, dirt, noise, and fumes from construction areas. Temporary access and detours should be provided to ensure safe, unimpeded pedestrian travel in and around work zones. Access to pedestrian facilities, such as bus stops, crosswalks, and links between origins and destinations, should be provided. Pedestrians should feel safe and secure when traveling near work zones.

Urban and suburban settings have the highest volume of pedestrian traffic, and construction projects are most likely to impact pedestrians in these areas. Pedestrians may ignore a detour that is out of the direction of their travel. Safe and convenient passage through or around work zones should be provided.

Local jurisdictions responsible for traffic safety in work areas should train construction inspection staff to recognize improper and unsafe pedestrian facilities during construction.

Protective Barriers

Near work zones where higher volumes of pedestrian traffic or school children exist, pedestrian fences or other protective barriers may be needed to prevent pedestrian access into a construction area. Pedestrian fences need to be high enough to discourage pedestrians from climbing over the fence. Considerations for encouraging safety in work zones are highlighted on the next page.

Pedestrian fences or other protective barriers may be needed to prevent pedestrian access into construction areas.

IN THIS SECTION

- *PEDESTRIAN SAFETY IN WORK ZONES*
- *ONGOING PEDESTRIAN FACILITY MAINTENANCE*
- *OTHER RESOURCES*

Considerations for Pedestrian Safety in Work Zones

- ***Separate pedestrians from conflicts with construction vehicles, equipment, and operations.***
- ***Separate pedestrians from conflicts with traffic traveling around or through the construction area.***
- ***Provide a safe, convenient, and accessible route that maintains the direction and character of the original route.***
- ***Minimize work vehicles crossing pedestrian routes by minimizing the number of construction access points.***
- ***Communicate construction activity and pedestrian impacts through local media and pedestrian interest groups.***
- ***Avoid using delineating materials that are difficult to recognize by people with impaired vision.***

Source: Based on ITE Design and Safety of Pedestrian Facilities; adapted and expanded for this Guidebook

Covered Walkways

For construction of structures adjacent to sidewalks, a covered walkway may be required to protect pedestrians from falling debris.

Covered walkways should be designed to provide:

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

Construction barrier in Paia, Maui

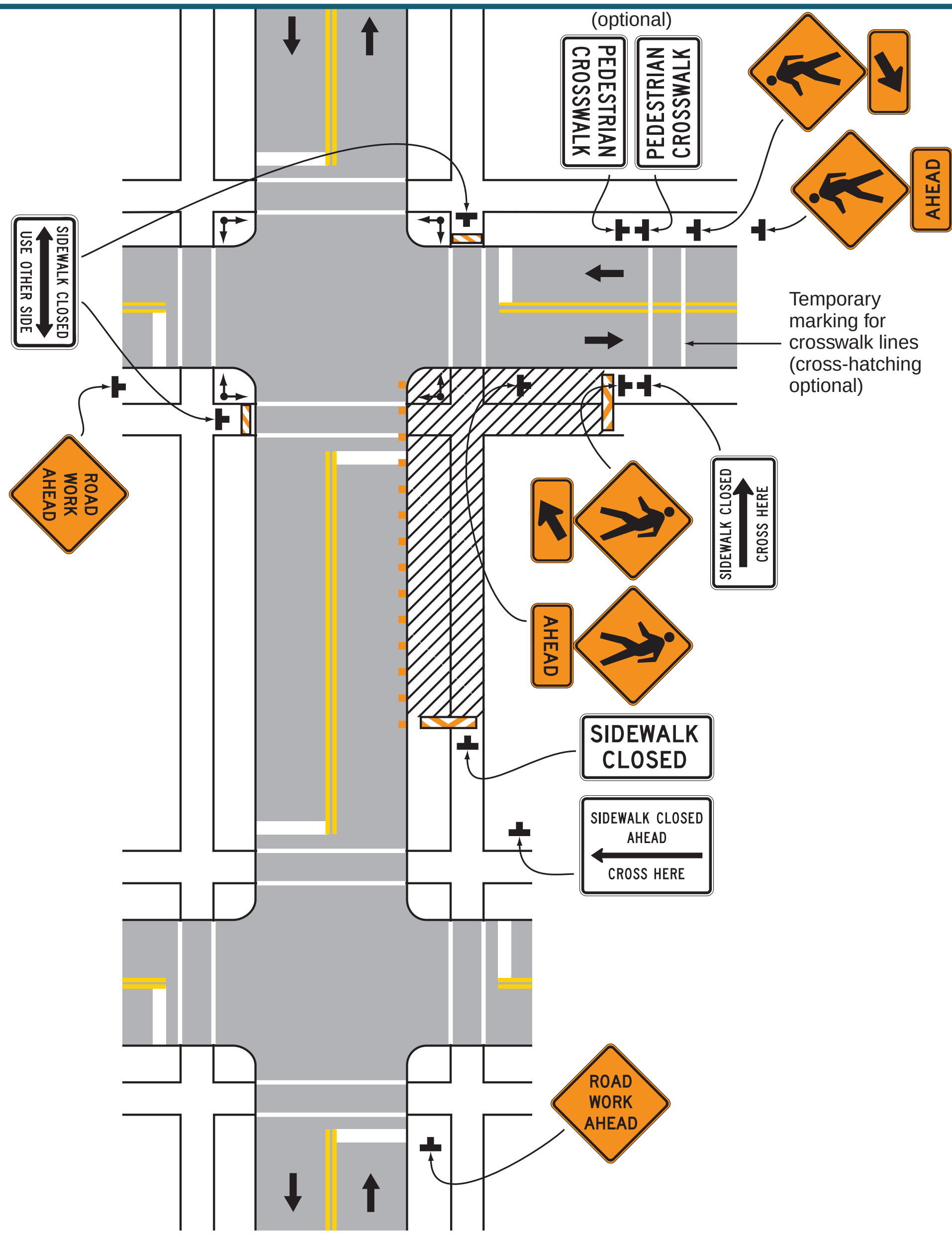
Sidewalk Closure During Construction

It is undesirable to close sidewalks or pathways during construction. If unavoidable, consider:

- Using barricades and cones to create a temporary route
- Clearly defining any detour routes
- Maintaining a route that complies with the Americans with Disabilities Act (ADA) design requirements
- Protecting pedestrians from vehicle traffic
- Protecting pedestrians from hazards, such as holes, debris, dust, and mud

If a temporary route is created in the roadway adjacent to the closed sidewalk, the parking lane or one travel lane may be used for pedestrian travel, with appropriate barricades, cones, and signing, as illustrated in Exhibits 11.1 and 11.2. When a parking lane or travel lane is not available for closure, pedestrians must be detoured with advance signing in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD). Signs should be placed to avoid blocking the path of pedestrians.

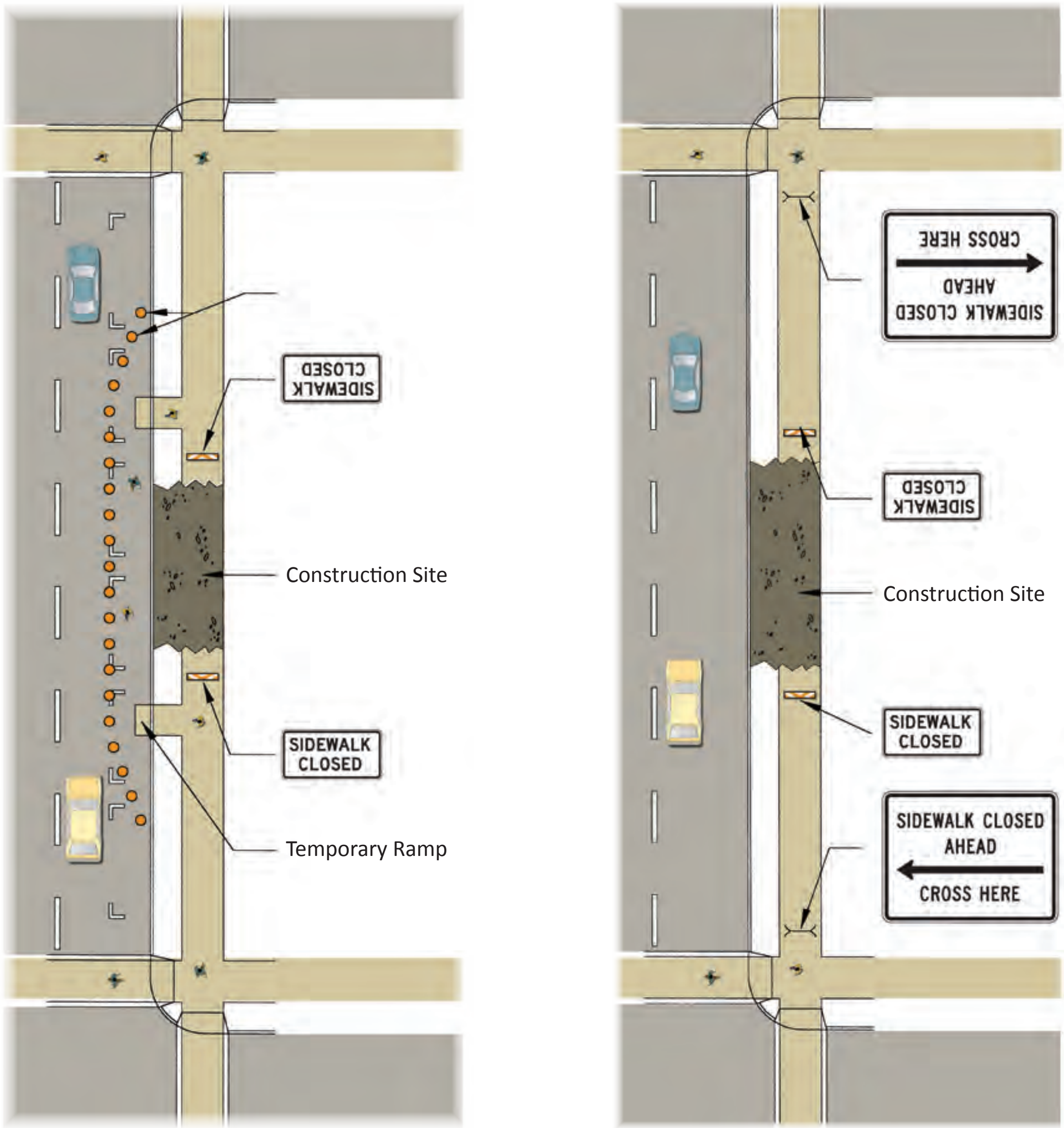
EXHIBIT 11.1 *Crosswalk Closures and Pedestrian Detours*



A path is provided for pedestrians and bicyclists during road closure.

This boulevard shoulder is transformed into a walkway with an extruded curb, concrete barrier and fencing.

EXHIBIT 11.2 *Temporary Pedestrian Routes*



Note: Parking lane used for pedestrian travel.

Note: If travel or parking lane is not available, detour pedestrians with advanced signing.

Intersections and Crossings Near Work Zones

- At intersections, avoid closing crosswalks.
- At signalized intersections, mark temporary crosswalks if they are relocated from their previous location. Maintain access to pedestrian push buttons.
- Include pedestrian phases in temporary signals.

Place advanced signing at intersections to alert pedestrians of mid-block work sites and direct them to alternate routes.

Utility Coordination

Construction and installation of utility lines and elements should be coordinated between the utility company and local agency with jurisdiction over the street system. Interruptions to pedestrian travel need to be minimized, and construction should avoid damage to pedestrian facilities. In some cases, it may be possible to improve conditions for pedestrians as part of an overall utility project. Such a project may create the opportunity to relocate a utility pole or box outside the pedestrian travel way, and even relocate utility lines along underground trenches.

Work Zone Maintenance

Pedestrian facilities in and adjacent to work zones should be maintained to provide safety and functionality. Proper maintenance will maximize the effectiveness and life of work zone pedestrian facilities. Poor maintenance can result in increased crashes and incidents in work zones. Exhibit 11.3 summarizes recommended maintenance activity for pedestrian facilities in and adjacent to work zones.

Ongoing Pedestrian Facility Maintenance

Clear and level surfaces are essential for pedestrians, particularly for people in wheelchairs, people who are blind or have impaired vision, older adults, and young children. Pedestrian facilities require regular maintenance to reduce the damages over time from weather and use. Local jurisdictions are responsible for maintaining facilities and traffic control elements at intersections and mid-block crossings.

Many maintenance issues can be reduced if properly addressed in the planning and designing phases before construction begins.

EXHIBIT 11.3 Work Zone Maintenance

WORK ZONE MAINTENANCE	
CONCERN	RECOMMENDED MAINTENANCE
Temporary pathways constructed of inexpensive, short-life materials	Pathway surfaces should be inspected regularly; surface materials should be treated with nonslip materials; surface materials with holes, cracks, or vertical separation should be replaced.
Detour pedestrian paths increase volumes of pedestrians on detour roadway	Detour pathway should be inspected regularly for adequacy of signal timing, signing, and pedestrian traffic hazards.
Construction material debris on pathway	Require contractor to maintain clear pathways.
Changing pedestrian route during construction	Inspect pedestrian signing regularly to ensure a clearly understood pathway.
Damaged traffic barriers	Replace and reevaluate adequacy for pedestrian safety.

Examples of restricted pedestrian access in Honolulu; in general it is a preferred practice to provide alternative access to pedestrians and bicyclists during construction, rather than fully blocking access as shown in these examples.

EXHIBIT 11.4 Maintenance Recommendations for Sidewalks

MAINTENANCE RECOMMENDATIONS FOR SIDEWALKS	
CONCERN	MAINTENANCE ACTIVITY
Tree roots cracking and heaving sidewalk	Remove failed sidewalk, cut roots and install new sidewalk. A local arborist should be contacted prior to removing large roots. Install root barriers or use a root box/structural soil system beneath the trees to promote deep root growth.
Section pop-up of vertical height greater than 0.5 in (13 mm)	Replace defective sections or provide temporary asphalt shim or grind pop-up.
Separation of expansion and construction joints greater than 1/4 in (6 mm)	Fill joints with hardening expansion compound.
Trash, loose sand, oil and grease on walkways and sidewalks	Send notice to abutting landowners to clean and maintain sidewalks.
Materials, signs, vending machines, etc. restricting effective sidewalk width	Require responsible parties to remove obstructions.
Low hanging tree limbs, bushes, weeds, and other foliage growing into the sidewalk and/or posing obstructions	Enact and enforce local regulations requiring abutting land users to perform timely clearance activity. Hire private contractor to clear sidewalk and assess cost to abutting land users.

ADA Title II implementing regulations require the maintenance of accessible features. General sidewalk maintenance recommendations are listed in Exhibit 11.4.

Walkway Surface

Pedestrian travel surfaces must be maintained to ensure that an even and unobstructed horizontal surface is maintained and in safe operating condition for all users at all times. Walkway surfaces that have settled or heaved over time can be a significant barrier for pedestrians.

Public works departments should have a program for routine maintenance checks of walkways, and they also should have a process in place to quickly respond to citizen reports of damaged surfaces, particularly along high-priority routes, so that pedestrians with mobility impairments do not have to seek alternate routes.

Surface Water Drainage

Drainage systems should be kept in good working order to avoid accumulation of water over pedestrian walking areas. Debris should be cleaned out from all gutters and drains. Litter should be removed from any low impact design facilities.

Signs, Signals, and Pavement Markings

Pedestrian and wayfinding signs need to be maintained to ensure that they are clear and legible, kept at the correct height and angle to the street, unobscured by tree branches and updated or replaced so that the information they provide remains valid. It is strongly recommended that a pedestrian sign plan be developed and maintained by local jurisdictions, detailing the content of each sign so that updates and maintenance can be managed.

Crosswalks and pavement markings should be added to a regular inspection and maintenance schedule, so that they are clearly visible at all times.

Traffic control devices, signals, and actuators also should be inspected on a regular basis to ensure that they are functioning properly.

Utility Provider Responsibilities

When work is undertaken for existing or new utilities, it is the responsibility of the utility provider to reinstate any and all disturbed elements within the pedestrian realm to their original quality.

Government agencies supervising the work should ensure that the placement of at- or above-grade utility assets does not detract from the public realm, impair pedestrian and vehicular sight lines, and/or obstruct pathways.

Trees and Plantings

Landscaping should be designed to last at least twenty years or longer, avoiding the need for frequent replacement. The placement and type of trees should be evaluated ahead of time, whenever possible. Trees and planting areas require regular trimming and maintenance to ensure that they are kept clear of debris and rubbish and that foliage does not obstruct sight lines or lighting. Care should be taken to prevent vegetation from encroaching into walkways. Dead and dying trees and plants can be a safety issue if limbs and branches fall into the traveled way or obstruct pedestrian areas.

When trees lack ample space for development, roots will often heave and crack sidewalks. Several alternatives have proved successful when planting trees near sidewalks. First, it is important that the variety of tree be suited to the site. Next, if the area has compacted soils

Keep the pedestrian realm clear and free of obstructions.

Workers replace a section of sidewalk. (www.leesburgva.gov)

Crosswalks and pavement markings should be added to a regular inspection and maintenance schedule.

Plants encroach the shoulder along this highway. (Barbara Gossett)

with low permeability rates, it is best to remove the existing soil and provide structural soil for the tree to grow freely. In order for a tree to reach maturity, there should be enough room for the tree's trunk to expand. Root barriers, grates with removable sections and larger sidewalk openings can prevent trees from heaving a sidewalk. The use of root boxes and structural soil box systems can also promote deep root growth.

A regular maintenance program needs to be established with suitably qualified staff inspecting and maintaining the health and suitability of planted areas.

Street Furniture

When street furniture is provided as part of street design and construction, it is important to ensure that these furnishings are maintained to a suitable standard to meet the purposes for which they were installed.

Other Resources

- American Association of State Highway and Transportation Officials. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.
- Federal Highway Administration. *Manual on Uniform Traffic Control Devices,* 2009.
- Institute of Traffic Engineers. *Design and Safety of Pedestrian Facilities.* 1998.
- New York State Department of Transportation. *Tree Selection Criteria.* Website: **https://www.nysdot.gov/divisions/engineering/design/landscape/trees/rs_selections** (May 2013).

Sidewalk cutouts provide a larger growing space for trees. Keep in mind that a minimum 4 ft horizontal clearance shall be provided along pedestrian access routes. (American Public Works Association)

1180
NAKUI ST
Island
Sotheby's
5123
RE TOURS
GRAY LINE
w.polyad.com
ElDorado National

Appendix

The farmers market attracts pedestrians of all ages.

GLOSSARY

Some of the most commonly referenced terms (and acronyms) in the toolbox are described below and on the following pages.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
nonprofit, nonpartisan association representing highway and transportation departments in the 50 states, the District of Columbia, and Puerto Rico; primary goal is to foster the development, operation, and maintenance of an integrated national transportation system; publishes several design guides

ACCESS MANAGEMENT
the principles and techniques used to control access to a highway, roadway, or street

ACCESSIBILITY
a condition that accommodates people with disabilities; ease of access for pedestrians

ACCESSIBLE PEDESTRIAN SIGNAL (APS)
a device that communicates information about pedestrian signal timing in a nonvisual format including audible tones, verbal messages, and/or vibrotactile information

AVERAGE DAILY TRAFFIC (ADT)
measurement of the average number of vehicles passing a certain point each day on a highway, roadway, or street

ALLEY
a road primarily used to access the rear of residences and businesses, not designed for general travel

AMERICANS WITH DISABILITIES ACT OF 1990 (ADA)
civil rights legislation passed in 1990, effective July 1992; mandated sweeping changes in building codes, transportation, and hiring practices to prevent discrimination against persons with disabilities; the federal law prohibiting discrimination against people with disabilities; requires public entities and public accommodations to provide accessible accommodations for people with disabilities

AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES (ADAAG)
provides scoping and technical specifications for new construction and alterations undertaken by entities covered by the ADA

APPROACH
section of the accessible route that flanks the landing of a curb ramp. The approach may be slightly graded if the landing level is below the elevation of the adjoining sidewalk

ARTERIAL
a street or roadway that provides the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control

ASPHALT CONCRETE
a concrete composition in which asphalt is used as a binder; a material often used for roadway pavement

AT-GRADE CROSSING
the general area where two or more roadways, railways, and/or pathways join or cross, as in an "at-grade railroad crossing"

AUDIBLE WARNING
see Accessible Pedestrian Signal

BARRIER CURB
see Vertical Curb

BICYCLE
a vehicle having two tandem wheels, propelled solely by human power, upon which any person or persons may ride. A three-wheeled adult tricycle is considered a bicycle

BICYCLE FACILITY
a general term denoting improvements and provisons made by public agencies specifically to accommodate or encourage bicycling, including parking and storage facilities

BICYCLE LANE/BIKE LANE
a portion of a roadway that has been designated by striping and pavement markings for the preferential or exclusive use by bicyclists

BICYCLE PATH
a bikeway physically separated from motorized vehicle travel

BICYCLE ROUTE
a shared roadway that has been designated by signing as a preferred route for bicycle use; also called a signed shared roadway

BIKEWAY
a general term for any road, street, path, or way that is used for bicycle travel regardless of whether such facilities are designated for exclusive use by bicycles or are to be shared by other transportation modes; a bikeway may be signed or unsigned for bicycle use

BOLLARD
a post or similar obstruction that prevents the passage of vehicles; the spacing of bollards usually allows the passage of bicycles and pedestrians; bollards may incorporate lighting

BOULEVARD
street classification encouraging physical design features that provide a park like atmosphere and/or enhance appreciation or use of adjacent parkland, on a street otherwise intended to move traffic

BUFFER
a strip of land that physically and/or visually separates two land uses, especially if the uses are incompatible

BUILDING FRONTAGE ZONE
area along right-of-way that functions to provide space between the building facade, wall, fence or other edge and the through zone of the sidewalk

BULB-OUT
see Curb Extension

BUS PULL OUT/TURN OUT
a section of pavement at a bus stop that allows buses to leave the flow of traffic while stopped to load and unload passengers

BUS SHELTER
any covered area within a bus stop zone that provides riders protection from the weather

BUS ZONE
a portion of the roadway along the curb which

is reserved for loading and unloading of either local transit or school buses

CATCH BASIN

a receptor, typically of masonry with cast iron top grate, that receives surface water runoff or drainage

CENTRAL BUSINESS DISTRICT (CBD)

a traditional downtown area usually characterized by established business fronting the street, sidewalks, slow traffic speeds, on-street parking, and a compact grid street system

CENTER LINE

the line separating traffic traveling in opposite directions

CHIP SEAL

a thin asphalt surface treatment used to waterproof and improve the texture of the wearing surface of a pavement

CLEARANCE, LATERAL

the width required for safe passage as measured in a horizontal plane

CLEARANCE, VERTICAL

the height required for safe passage as measured in a vertical plane

COLLECTOR

a street designated to carry traffic between arterials and local streets

COMMERCIAL LOAD ZONE

a portion of a street designated by a sign and yellow paint markings, reserved for the exclusive use of vehicles with a valid commercial load zone permit

COMMERCIAL FACILITY

a facility that is intended for nonresidential use by private entities and whose operation brings about commerce

COMPLETE STREETS

streets and roadways and street/roadway networks that provide for the accomodation of all users regardless of their age, ability, or preferred mode of transportation; the Hawaii Department of Transportation has an adopted Complete Streets policy

CONCRETE

a hard, strong construction material made by mixing a binder such as portland cement or asphalt with a mineral aggregate (sand and gravel) so that the entire mass is bound together and hardened

CROSS SECTION

diagrammatic presentation of a highway profile at right angles to the centerline at a given location

CROSSING ISLAND

pedestrian refuge within the right-of-way and traffic lanes of a highway or street

CROSSWALK

portion of a roadway designated for pedestrian crossing, marked or unmarked; unmarked crosswalks are the natural extension of the shoulder, curb line, or sidewalk

CROSSWALK BEACON

amber flashing lights, usually accompanied by a sign, used to notify motorists of a pedestrian crosswalk

CROSS SLOPE

the slope measured perpendicular to the direction of travel

COMMUTE TRIP REDUCTION (CTR)

a program that either requires or encourages major employers to take measures to reduce the number of single-occupant vehicle trips and the number of vehicle miles traveled by their employees

CUL-DE-SAC

a street closed at one end that is enlarged to provide turn around space for motor vehicles

CULVERT

a transverse drain under a roadway, canal, or embankment other than a bridge; most culverts are fabricated with materials such as corrugated metal and precast concrete pipe

CURB

a rim along a street or roadway, an edge for a sidewalk; a curb is usually constructed from cement concrete, asphalt concrete, or granite; curbs create a physical barrier between the roadway and the planting strip, which provides a safer environment for pedestrians, and facilitates street drainage

CURB BULB

an extension of the curb line into the roadway

CURB CUT

used to describe a depression in the curb to accommodate a driveway; where there is no curb, the point at which the driveway meets the roadway pavement is considered the curb cut

CURB EXTENSION

a section of sidewalk extending into the roadway at an intersection or midblock crossing that reduces the crossing width for pedestrians and may help reduce traffic speeds

CURB LINE

the edge of a roadway; it may or may not be marked by a curb

CURB RADIUS

refers to the degree of curvature of the curb at a corner; other conditions being equal, a large curb radius allows right-turning vehicles to turn more quickly than a small curb radius

CURB RAMP

the area of the sidewalk, usually at the intersection, that allows easy access/transition for wheelchairs, strollers, and other wheeled equipment, between the sidewalk and the street

DEAD-END STREET

street-end formed when an existing right-ofway is not platted through from street to street, or when topography or other conditions preclude a street from being improved to its full length

DETECTABLE WARNING

standardized surface feature built in or applied to walking surfaces or other elements to warn pedestrians with vision impairments of hazards on a sidewalk and or loading platform, such as the curb line or drop-off

DIAGONAL CURB RAMP

curb ramp positioned at the appex of the curb radius at an intersection, bisecting the corner angle

DEPARTMENT OF TRANSPORTATION (DOT)

may refer to US DOT or a state DOT

DRAINAGE INLET
site where water runoff from the street or sidewalk enters the storm drain system. The openings to drainage inlets are typically covered by a grate or other perforated surface to protect pedestrians

DRAINAGE SWALE
a shallow, grassy drainage channel that accommodates surface water runoff; used on street, without curbs and gutters

DRIVEWAY
the portion of the street or alley area which provides vehicle access to an off-street area through a depression in the curb

DRIVEWAY CROSSING
extension of sidewalk across a driveway that meets the requirements of ADAAG

EDGE ZONE
interface between on-street parking or motor vehicle travel lane; the curb line

EFFECTIVE SIDEWALK WIDTH
the width of the sidewalk area available for walking or wheelchair travel, unobstructed by street furniture or other impediments

EXTENSION ZONE
combination of the furnishings and edge zone; additional space for pedestrians and streetscape elements; often utilized with curb extensions/ bulb-outs at block ends or mid-block

FEASIBLE
capable of being accomplished with a reasonable amount of effort, cost, or other hardship. With regard to ADA compliance, feasibility is determined on a case-by-case basis

FEDERAL HIGHWAY ADMINSITRATION (FHWA)
agency of the US Department of Transportation with jurisdiction over highways

FESTIVAL STREET
see shared street/shared space; also a street segment that is designed to be closed to motor vehicle travel during special events, such as farmers markets or street fairs

FIRE LANE
an area on public or private property reserved for providing fire department access to structures, fire-sighting fixtures, or equipment

FLARE
sloped surface that flanks a curb ramp and provides a graded transition between the ramp and the sidewalk. Flares bridge differences in elevation and are intended to prevent ambulatory pedestrians from tripping. Flares are not considered part of the accessible route

FOG LINE
the white line at the outside edge of the motor vehicle travel lane, used to designate the boundary of the vehicle travel lane

FRONTAGE ROAD
a road designated and designed to serve local traffic parallel and adjacent to a highway or arterial street

FEDERAL TRANSIT ADMINISTRATION (FTA)
agency of the US Department of Trnasportation with jurisdiction over transit

FURNISHINGS ZONE
primary buffer space between the active pedestrian walking area of the through zone and adjacent throughfares

GAP
(1) an opening embedded in the travel surface. Railroad and trolley tracks and concrete joints are common gaps that pedestrians must negotiate. Wheelchair casters and tires of road bicycles can get caught in poorly placed gap openings; or (2) a break in the flow of vehicular traffic, sufficiently long enough for a pedestrian to cross to the other side of the street or to a place of refuge

GRADE
the slope parallel to the direction of travel that is calculated by dividing the vertical change in elevation by the horizontal distance covered, measured in percent; also: a measure of the steepness of a roadway, bikeway, or walkway, expressed in a ratio of vertical rise per horizontal distance, usually in percent; e.g. a 5 percent grade equals 5 ft of rise over a 100 ft horizontal distance

GRADE-SEPARATED CROSSING
a facility such as an overpass, underpass, skywalk, or tunnel that allows pedestrians and motor vehicles to cross each other at different levels

GRADE SEPARATION
the vertical separation of conflicting travelways with a structure

GRATE
a framework of latticed or parallel bars that prevents large objects from falling through a drainage inlet but permits water and some sediment to fall through the slots. Wheelchair casters and tires of road bicycles can get caught in poorly placed grate openings

GREEN STREETS
streets that integrate sustainable features, including low impact development and stormwater management and treatment; streets that emphasize travel by pedestrians, bicycles, and transit; could include all of the above

GREEN TIME
the length of time a traffic signal indicates a green light

GUIDESTRIP
some type of raised material with grooves that pedestrians with vision impairments use for cane directional cues. For example, guidestrips may be used by pedestrians with vision impairments to navigate a crosswalk, track to an emergency exit, or access the door of a light rail system

GUTTER
trough or dip used for drainage purposes that runs along the edge of the street and curb or curb ramp

HAWAII DEPARTMENT OF TRANSPORTATION (HDOT)
responsible to plan, design, construct, operate, and maintain State facilities in all modes of transportation, including air, water, and land. Coordination with other State, County, and Federal programs is maintained in order to achieve these objectives.

HAWAII DISABILITY AND COMMUNICATION ACCESS BOARD (DCAB)
an advisory board of governor-appointed members that serve as public advocates of persons with disabilities, establish guidelines for the design of buildings and facilities, issue administrative rules for the utilization of communication access services, and administer the statewide program for the issuance of parking placards to disabled persons

HEARING IMPAIRMENT/HEARING-IMPAIRED

condition of partial loss of hearing or total deafness

HIGHWAY

a general term denoting a public way for purposes of travel, including the entire area within the right-of-way

HIGH OCCUPANCY VEHICLE (HOV)

a car carrying enough people to be able to travel in the HOV/diamond lane or a vanpool or bus

INLET

an opening at the surface of the ground through which runoff water enters the drainage system

INTERMODALISM

a transportation policy that promotes full development of multiple alternative modes of travel, and encourages the optimization of mode or combination of modes for travel mobility, efficiency, sustainability, economy, and environmental health. The availability, effectiveness, and safety of pedestrian facilities contribute to the achievement of intermodalism

INTERSECTION

a place or area where two or more roads or pathways cross

JAYWALKING

crossing a street illegally; includes walking against a traffic control device or stepping out in front of a moving vehicle so as to present an immediate danger, whether in a crosswalk or not, or crossing at an intersection outside of a crosswalk

KINESTHETIC

sensory experience derived from the movement of the body or limbs

KIOSK

a small freestanding structure either open or partially closed, where merchandise is displayed, advertised, or sold, or where notices are displayed

LANDING

level area of sidewalk at the top or bottom of a ramp

LANDSCAPE LIGHTING

lighting that is designed to accompany and illuminate landscaping features

LANE LINE

a solid or broken paint line or other marker separating lanes of traffic moving in the same direction

LEGEND

words, phrases, or numbers appearing on all or part of a traffic control device; also the symbols that appear on maps

LOADING AND UNLOADING ZONE

a portion of the street or alley, designated by a sign and white paint markings, reserved for picking up and dropping off people or property

LOCAL ROAD/STREET

road that serves individual residences or businesses, and/or distributes traffic within a given urban or rural area; a street designated to provide access to and from residences or businesses

LOCATOR TONE

a repeating sound that informs approaching pedestrians that they are required to push a button to actuate the pedestrian signal. This tone enables pedestrians with vision impairments to locate the pushbutton

LOOP DETECTOR

a wire buried in the street and connected to a traffic signal allowing the signal to sense the presence of vehicle traffic

MAIN STREET

a type of street that is the primary place for multi-modal travel and interaction in a town; highways often are also main streets in small towns and villages

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)

approved by the Federal Highway Administration as a national standard for placement and selection of all traffic control devices on or adjacent to all highways open to public travel

MARKED CROSSWALK

any portion of the roadway distinctly indicated for pedestrian crossing by lines or other markings

MEDIAN

a physical barrier, or a solid yellow or cross hatched pavement marking at least 18" in width, which divides any street into two or more roadways

MEDIAN ISLAND

an island in the center of a road that physically separates the directional flow of traffic and can provide pedestrians with a place of refuge and reduce the crossing distance

MID-BLOCK CROSSING

a crossing point positioned within a block rather than at an intersection

MINIMUM CLEARANCE WIDTH

the narrowest point on a sidewalk or trail. A minimum clearance width is created when obstacles, such as utility poles or tree roots, protrude into the sidewalk and reduce the design width

MOTOR VEHICLE

a vehicle that is self-propelled or propelled by electric power but not operated upon rails; excludes a moped

MOVING AHEAD FOR PROGRES N THE 21ST CENTURY 21ST

Federal transportation legislation that authorizes Federal-aid highway trnasportation programs, including the Transportation Alternatives Program (TAP) that provides funding for pedestrian and bicycle projects and safe routes to school

MOUNTABLE CURB

see Sloping Curb

MULTI-USE PATH/TRAIL

see Shared Use Path

NATIONAL HIGHWAY COOPERATIVE HIGHWAY RESEARCH PROGRAM (NCHRP)

a program that conducts research in problem areas that affect highway planning, design, construction, operation, and maintenance in the United States

NEW CONSTRUCTION

project where an entirely new facility will be built from the ground up

NATIONAL HIGHWAY SYSTEM (NHS)

National Highway System; designated by the US Congress; contains all interstate routes, a large percentage of urban and rural principal arterials, and strategic highways and connectors

OBSTACLE

an object that limits the horizontal or vertical passage space, by protruding into the circulation route and reducing the clearance width of a sidewalk

OFF-STREET PARKING

publicly or privately owned parking located outside the street right-of-way; may be perpendicular, angled, or parallel

ON-STREET PARKING

parking located within the public right-of-way; may be parallel, angled (front-in or back-in); typically not perpendicular; provides a buffer between vehicle travel lanes and sidewalk/ walkway areas

OPEN SPACE

land and/or water area with its surface open to the sky or predominantly undeveloped, which is set aside to serve the purposes of providing park and recreation opportunities, conserving valuable resources, and structuring urban development and form

OUTDOOR DEVELOPED AREAS ACCESSIBILITY GUIDELINES (ODAAG)

guidelines for accessibility for outdoor developed areas administered by the US Access Board

PARALLEL CURB RAMP

curb ramp design where the sidewalk slopes down on either side of a landing. Parallel curb ramps require users to turn before entering the street

PARKING

see off-street parking and on-street parking

PASSING SPACE

section of path or sidewalk wide enough to allow two wheelchair users to pass one another or travel abreast

PATH OR PATHWAY

track or route along which pedestrians are intended to travel

PAVEMENT MARKINGS

painted or applied lines or legends placed on a roadway surface for regulating, guiding or warning traffic

PED SHED

see WALK SHED

PEDESTRIAN

a person afoot, in a wheelchair, or in a vehicle propelled by a person afoot

PEDESTRIAN ACCESS ROUTE (PAR)

a continuous, unobstructed path connecting all accessible elements of a pedestrian system that meets the requirements of ADAAG

PEDESTRIAN-ACTUATED TRAFFIC CONTROL

pushbutton or other control operated by pedestrians designed to interrupt the prevailing signal cycle to permit pedestrians to cross a signalized intersection or midblock crossing

PEDESTRIAN AND BICYCLE INFORMATION CENTER (PBIC)

non-profit organization commited to improving the quality of life in communities through the increase of safe walking and bicycling as a viable means of transportation and physical activity; website www.pedbikeinfo.org serves as a clearinghouse for research, statistics, design guidance and other information

PEDESTRIAN DETECTORS

devices, usually push-button activated, that allow pedestrians and bicyclists to change the signal light at a crosswalk

PEDESTRIAN FACILITY

a facility provided for the benefit of pedestrian travel, including walkways, crosswalks, signs, signals, and illumination

PEDESTRIAN HALF SIGNAL

a traffic control signal often located at the junction of an arterial and a residential street, which provides pedestrian signals for crossing the arterial but not for crossing the residential street

PEDESTRIAN OVERPASS

a pedestrian walkway above the grade of the roadway, which allows pedestrians to cross the roadway without interacting with motor vehicles

PEDESTRIAN REALM

area where pedestrian travel occurs; generally located between the curb line and right-of-way line and also including crossings at intersections and mid-block; the pedestrian realm is intended for pedestrian use and offers opportunity to incorporate urban design elements, based on the adjacent land use

PEDESTRIAN REFUGE ISLAND

a defined area between traffic lanes that provides a safe place for pedestrians to wait as they cross the street

PEDESTRIAN SCALE LIGHTING

overhead street lighting which is typically over the sidewalk instead of the roadway, and at a lower height than typical street light fixtures; providing illumination for pedestrians instead of motorists

PEDESTRIAN SIGNALS

electronic devices used for controlling the movement of pedestrians at signalized midblocks or intersections, which may include the “walk/don’t walk” messages or the symbolic walking person/hand message

PEDESTRIAN WALKWAY

a surfaced walkway, separated from the roadway, usually of constructed of asphalt, concrete, compacted crushed rock, unit pavers, or other firm, stable, slip resistant surface, following the existing ground suface/at grade and distinguished from sidewalk by typically not being adjacent to curb and gutter

PEDESTRIAN-FRIENDLY

describing an environment that is pleasant and inviting for people to experience on foot; specifically offering sensory appeal, safety, street amenities such as plantings and furniture, good lighting, easy visual and physical access to buildings, and diverse activities

PERPENDICULAR CURB RAMP

curb ramp design where the ramp path is perpendicular to the edge of the curb

PLANTING STRIP

the street right-of-way area lying between the constructed curb and the sidewalk

PLAY STREET

see shared street/shared space; also a segment of neighborhood street that may be closed to motor vehicle traffic or marked temporarily at certain times for play

PRINCIPAL ARTERIAL

a main traffic route which connects major activity centers, usually characterized by trip lengths of two miles or more

PUBLIC RIGHTS-OF-WAY ACCESSIBILITY GUIDELINES (PROWAG)
guidelines for design of accessible public rights-of-way administered by the US Access Board

RAMP
sloped transition between two elevation levels

RESIDENTIAL PARKING ZONE
a designated zone in which on-street parking for the general public is restricted. Residents of the area are exempted from the parking restrictions by permit

RESIDENTIAL STREET
a non-arterial street that provides access to residential land uses, and connects to higher level traffic streets; also called residential access street

RESURFACING
the placing of a new surface on an existing pavement to improve its conformation or to increase its strength

RETAINING WALL
a structure used to sustain the pressure of the earth behind it

RIGHT-OF-WAY
a strip of land platted, dedicated, condemned, established by prescription, or otherwise legally established for the use of pedestrians, vehicles or utilities; the legal right of one vehicle, bicycle, pedestrian, or device to proceed in a lawful manner in preference to another vehicle, bicycle, pedestrian, or device; also: real property rights (whether by fee-simple ownership, by easement, or by other agreement) acquired across land for a public purpose, including pedestrian use

ROADWAY
the portion of the highway or street improved, designed, or ordinarily used for vehicular travel; excludes the berm or shoulder

ROOT BARRIER
a barrier installed in tree wells/pits and planting strips that directs root growth away from paved areas, utilities, or other elements

RULES OF THE ROAD
the portion of a motor vehicle law that contains regulations governing the operation of vehicular and pedestrian traffic

RURAL
areas outside the boundaries of urban areas

SANDWICH BOARDS/SOFT SANDWICH
stand-up A-shaped signs often placed on the sidewalk or street right-of-way to advertise a business or an attraction

SCHOOL CROSSING
a crossing adjacent to a school or on established school pedestrian routes, designated as a preferred crossing for school users

SCHOOL ZONE
an established reduced speed area; installed around established school crossing; speed limits are posted at 20 mph

SERVICE LANE
the curb lane that provides access to businesses for service vehicles

SETBACK
the required or actual placement of a building a specified distance away from a road, property line, or other structures

SHARED ROADWAY

a street or highway that is open to both bicycle and motor vehicle travel

SHARED STREET/SHARED SPACE

a segment of street that is designed to accommodate pedestrians, bicyclists, and motor vehicles moving together in the same space; typically very low speed, low vehicle volume streets in urban areas, town centers, or neighborhoods; typically includes special paving and often places street and sidewalk areas at the same grade (sometimes also called festival streets or play streets)

SHARED USE PATH

a path physically separated from motor vehicle traffic by an open space or barrier and either within a highway right-of-way or within an independent right-of-way, used by bicyclists, pedestrians, joggers, skaters and other non-motorized travelers (sometimes called a multi-use path or trail)

SHOULDER

the paved or unpaved area between the roadway edge and the property line contiguous to the travel lanes that provides space for emergency use by vehicles and for lateral support of base and surface courses; may be designed to be used by bicyclists and can be used informally by pedestrians but is not a recognized pedestrian facility

SHOULDER BIKEWAY

a type of bikeway where bicyclists travel on a paved shoulder

SHY DISTANCE

the distance between the edge of a travelway and a fixed object; or the area along sidewalk closest to buildings, retaining walls, curbs, and fences generally avoided by pedestrians

SIDEWALK

the improved portion of a street or roadway between the curb lines and the adjacent property lines, intended for use by pedestrians

SIGHT DISTANCE

the length of roadway visible to a driver; the distance a person can see along an unobstructed line of sight

SIGHT IMPAIRMENT/SIGHT-IMPAIRED

see vision impairment /vision-impaired

SIGNAL TIMING

the green time allotted each direction of travel; the time between start of green for adjacent/ sequential traffic signals

SIGNS

provide information to motorists, pedestrians, and bicyclists; white background indicates a regulatory sign; yellow background conveys a general warning message; green background shows permitted traffic improvements or directional guidance; florescent yellow/green background indicates pedestrian crossings and school zones; orange background is used for wanring and guidance in work zones (per the MUTCD)

SKEW ANGLE

the angle formed between a roadway, bikeway, or walkway and an intersecting roadway, bikeway, walkway, or railway, measured away from the perpendicular

SLOPE
ground that forms a natural or artificial incline

SLOPE LINE
the line where the graded portion of the roadway from the center line toward the edge changes to the transition slope required to meet the surface of the abutting private property

SLOPING CURB
a curb with a sloping face, usually on the order of 30-to-45 degrees from vertical, that can be traversed in emergency situations

SINGLE-OCCUPANT/OCCUPANCY VEHICLE (SOV)
a vehicle carrying only the driver and no passengers

STOP BAR
a painted stripe across a traffic lane to indicate where vehicles should stop at a stop sign or a traffic signal

STORM DRAIN
a system of gutters, pipes or ditches used to carry storm water from surrounding lands to streams and lakes, and larger bodies of water

STREET FURNITURE
accessories and amenities placed on sidewalks for the convenience and accommodation of pedestrians including elements such as benches or other seating, trash receptacles, drinking fountains, planter, kiosks, clocks, newspaper dispensers, or telephones

STREET IMPROVEMENT
an improvement in the public right-of-way, whether above or below ground, such as pavement, sidewalks, or a storm water drainage system

STREET TREE
a tree planted within public right-of-way

STREET TREE GRATES
grates, usually metal and often decorative, that cover street tree pits and allow air and water to reach the soil

STREET TREE PITS
cutouts from a sidewalk or paved planting strip, to allow air and water to reach the trees planted in the cutout

STREET-END
formed where an existing right-of-way ends or is not platted through from street to street, often due to topographical conditions (such as bluffs or shorelines)

STREETSCAPE
the visual character of a street as determined by elements such as structures, greenery, driveways, open space, view, and other natural and man-made components

STRUCTURE
a bridge, retaining wall, or tunnel

SUBURBAN
built up area surrounding a core urban area

SUSTAINABLE STREETS
integration of sustainable features in street design; may combine features of complete streets and green streets to meet environmental objectives

T-INTERSECTION
the meeting of two streets, usually perpendicular, where one of the streets does not continue through; approximately resembling the letter “t”

TACTILE WARNING/TACTILE WARNING STRIP

change in surface condition providing a tactile cue to alert pedestrians with vision impairments of a potentially hazardous situation

THROUGH ZONE

obstacle-free space for clear pedestrian through travel that is often the primary walking area of the sidewalk

TOUCH TECHNIQUE

environmental scanning method in which a blind person arcs a cane from side to side and touches points outside both shoulders. Used primarily in unfamiliar or changing environments, such as on sidewalks and streets

TRAFFIC ACTUATED SIGNAL

a signal that responds to the presence of a vehicle or pedestrian (for motor vehicles, loop detectors; for pedestrians, usually push buttons)

TRAFFIC CALMING

of or relating to transportation techniques, programs, or facilities intended to slow the movement of motor vehicles

TRAFFIC CONTROL DEVICE

any sign, signal, marking, or device placed or erected for the purpose of regulating, warning, or guiding vehicle traffic and/or nonmotorized traffic

TRAFFIC SIGNAL

any traffic device, whether manually, electrically, or mechanically operate, which assigns right-of-way to vehicles and pedestrians at intersections

TRAFFIC VOLUME

the given number of vehicles that pass a given point for a given amount of time (hour, day, year); see "ADT"

TRANSIT STOP OR TRANSIT STATION

a regular stopping place on a transit route that may include transit shelter and parking

TRANSPORTATION AGENCY

Federal, state, or local government entity responsible for planning, designing, constructing, and operating transportation systems and facilities for a particular jurisdiction

TRANSPORTATION ALTERNATIVES PROGRAM (TAP)

Program of the Moving Ahead for Progress in the 21st Century federal legislation that administers funding for pedestrian and bicycle projects and safe routes to school

TRANSPORTATION DEMAND MANAGEMENT (TDM)

measures that are implemented to attempt to reduce the proportion of trips made by single-occupant vehicles

TRANSPORTATION RESEARCH BOARD (TRB)

a program in the United States that conducts research in problem areas related to planning, design, construction, operation, and maintenance for all types of transportation facilities and systems

TRANSPORTATION SYSTEM PLAN (TSP)

the overall plan for all transportation modes for a given area (usually city, county, or region)

TRAVEL LANE

roadway lanes on which traffic moves

TRUNCATED DOMES

small domes with flattened tops used as tactile warning at transit platforms and at other locations where a tactile warning is needed

TWO-WAY LEFT TURN LANE

a lane near the center of the roadway set aside for use by vehicles making left turns in both directions from or into the roadway

UNCONTROLLED INTERSECTION

an intersection where the right-of-way is not controlled by a stop sign, yield sign, or traffic signal

UNIFORM FEDERAL ACCESSIBILITY STANDARDS

accessibility standards that all Federal agencies are required to meet. Includes scoping and technical specifications

URBAN

places within boundaries set by state and local officials, having a population of 5,000 or more. Urban areas are often densely populated and contain a high density of built structures

URBAN AREA

the area immediately surrounding an incorporated city or rural community that is urban in character, regardless of size

URBAN TRAILS

off-road trails, special bike lanes, and signed routes in the street right-of-way

UNITED STATES ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD (US ACCESS BOARD)

independent Federal agency responsible for developing Federal accessibility guidelines under the ADA and other laws

UTILITIES

services and facilities such as water, sanitary sewer, storm drainage, elecricity, communication lines, and other elements, often located in street, roadway, and highway rights-of-way; typically housed in underground pipes, conduits, and vaults and may include some above ground features for access and control; above ground features need to be provided with clearance area for access and should be designed to avoid becoming obstacles in the pedestrian realm

UTILITY POLES

poles used to carry utility wires, such as electric, cable television, telephone, or electrified trolley wires that may be operated by telephone companies, power companies, or any combination of these and/or others

VEHICLE

a device in, upon or by which any person or property is or may be transported or drawn upon a highway, including mopeds and bicycles, but excluding toy bicycles, devices other than bicycles moved by human power, and devices used exclusively upon rails or tracks

VEHICLE MILES TRAVELED (VMT)

vehicle miles traveled describes the number of miles traveled during a typical trip (such as a commute trip) and can serve as an indicator for TDM activities

VERTICAL CLEARANCE

minimum unobstructed vertical passage space required along a sidewalk or trail. Vertical clearance is often limited by obstacles such as building overhangs, tree branches, signs, and awnings

VERTICAL CURB
a steep-faced curb, designed with the intention of discouraging vehicles from leaving the roadway

VIBROTACTILE PEDESTRIAN DEVICE
device that communicates information about pedestrian timing through a vibrating surface by touch

VISION IMPAIRMENT/VISION-IMPAIRED
loss or partial loss of vision; also may be called sight impairment; a blind person is one who has a total loss of vision

VISUAL WARNING
Use of contrasts in surface to indicate a change in environment, as at a curb ramp where the sidewalk changes to the street

WALK SCORE
a program that measures walkability of areas; www.walkscore.com

WALK SHED/PED SHED
a defined/analyzed geographic area that is the walkable area surrounding a specific pedestrian origin/destination, such as a transit station or school

WALKABILITY/WALKABLE AREAS
the extent to which an area accommodates pedestrians; walkable areas are pedestrian-friendly and encourage pedestrian travel

WALKABLE DISTANCES
recognized distances from an origin/destination that are conducive to encouraging walking; a five-minute/¼ mile zone is often used for the most walkable distance and ten-minute/½ mile zone is often used for the walkable distance

WALKWAY
a transportation facility built for use by pedestrians, including persons in wheelchairs; walkways include sidewalks, and paths

WALK INTERVAL
traffic signal phase in which the WALKING PERSON (symbolizing WALK) signal indication is displayed

WAYFINDING
a system of information comprising visual, audible, and tactile elements that helps users experience an environment and facilitates getting from point A to point B

WIDE OUTSIDE LANE
a wider than normal curbside travel lane that is provided for ease of bicycle operation where there is insufficient room for a bike lane or shoulder bikeway

WIDTH, SIDEWALK
total width of a sidewalk includes obstructions and begins at the edge of a roadway to the side of a building. Clear width is the portion of sidewalk that excludes obstructions and any attached curb. Effective width is the portion of clear width that excludes any shy distances

WOONERF OR SHARED STREET
a common space to be shared by pedestrians, bicyclists, and low-speed motor vehicles. These are usually narrow streets without curbs and sidewalks. Plantings, street furniture, and other obstacles are placed so as to discourage and inhibit through traffic movements

INDEX

Refer to the page numbers listed for primary information related to the subjects/topics below. These subjects also may be addressed secondarily on other pages of the toolbox.

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