County of Maui

Department of Public Works

Street Design Manual

December 2018

Alan M. Arakawa, Mayor

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County of Maui

Department of Public Works

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Acknowledgements

The original inspiration for this document came from the *Model Design Manual for Living Streets,* prepared by the County of Los Angeles.
(http://www.modelstreetdesignmanual.com/index.html)

After further consideration, this *Street Design Manual* was simplified to better meet the needs of the County of Maui.

The County of Maui acknowledges the many people and organizations who contributed to complete this document.

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Different consultants have assisted Maui with technical assistance and various projects, but each in some way has contributed to this manual.
Dan Burden
Dongho Chang
Jim Charlier
Deb Hubsmith
Gary Toth
Paul Zykofsky

Thank you to Peter Koonce for your expertise, eye opening discussions, practical sense, and all of your work getting us to this point.

The County of Kauai for sharing your knowledge and helping us develop a foundation to build upon.

The County of Maui gratefully acknowledges the State of Hawaiʻi Department of Health for funding the Healthy Eating + Active Living Coalition for Maui (HEAL) and many of the consultants who assisted with this effort, the Centers for Disease Control and Prevention (CDC), Communities Putting Prevention to Work (CPPW), and for also providing funding for consultants.

Many thanks to the Lauren Loor and the Built Environment Task Force of Maui HEAL and Laksmi Abraham of BlueZones Maui, who assisted with reviews.

Chapter 1: Introduction

Background

In 2009, the State of Hawai‘i adopted Act 054 (Hawai‘i Revised Statutes Section 264-20.5), which requires counties within the State to:

> *“adopt a complete streets policy that seeks to reasonably accommodate convenient access and mobility for all users of the public highways within their respective jurisdictions…including pedestrians, bicyclists, transit users, motorists, and persons of all ages and abilities…”*

In 2012, the County of Maui adopted Resolution 12-34, establishing a Complete Streets Policy for the County of Maui. Resolution 12-34 requires:

> *“that all roadway projects, including, design, planning, reconstruction, rehabilitation, maintenance, or operations in the County of Maui be balanced and equitable in accommodating and encouraging travel by bicyclists, public transportation vehicles and their passengers, and pedestrians of all ages and abilities in accordance with Complete Streets principles.”*

In addition, Resolution 12-34 calls for the County of Maui to:

> *“incorporate Complete Streets into all relevant County actions, including budgeting, planning, and development services, unless prohibited by law.”*

and that the County of Maui Council identifies

> *“Maui supports, as the policy of the County of Maui, the implementation of Complete Streets, consistent with Act 54 (2009) and the Countywide Policy Plan.”*

This manual is a step in the implementation of the County of Maui Complete Streets Resolution, as it serves as a design guide for street design and modifies County of Maui roadway design standards. It supports complete streets principles found in the Maui Long Range Transportation Plan and the growing theme and direction of feedback from residents regarding their communities.

Benefits of a Complete Streets Approach

In the past, streets have been designed for primarily one user: the automobile driver. With such an approach, common complaints and concerns received from other users such as pedestrians and bicyclists, are that streets feel unsafe or uninviting. Complete Streets takes a different approach, emphasizing that streets are an important element of our public realm, and that streets are for everyone. Streets should be designed for all users and modes, including autos, freight, emergency and service vehicles, transit, bicyclists and pedestrians. The many benefits of complete streets have been demonstrated, and include the following:

- Increased safety for all users.
- Improved personal health by encouraging “active” transportation, such as walking and bicycling.
- Improved transportation choice for all segments of the population, especially keiki and kupuna.
- Ability for kupuna to live independently even when driving is no longer an option.
- Ability for keiki to walk independently to school and safely explore their neighborhoods.
- Improved access for people with disabilities.
- Reduced per capita health costs.
- Reduced per capita transportation costs.
- Strengthened neighborhoods through enhanced socialization.
- Vitalized town centers and commercial districts.
- Reduced public health costs through reductions in disease.
- Reduced long-term public capital costs through reductions in expensive widening projects.
- Enhanced environmental quality through alternative storm water management and reduced impermeable pavements.
- Reductions in greenhouse gas emissions.
- Support of community history, culture and character.

A complete streets approach does not require or mandate that people change their modes of transportation. Rather, it offers transportation choices for everyone, and increases access for those who are unable to drive for physical or socio-economic reasons.

Complete streets is not a “one-size fits all” or “cookie cutter” approach. Rather, streets are designed for their environmental, cultural, and historic context. Complete streets support and enhance local community character. (See Chapter 8 for the Community Involvement process.)

Current Design Standards

The Standard Details for Public Works Construction, which compiled standard details for the Counties of Hawaii, Kauai, Maui and the City and County of Honolulu, were last officially updated in 1984. As such, these roadway standard details do not reflect current best practices for roadway design in the County of Maui. This manual provides updated guidance and standards related to roadway design. (See Chapters 2, 3 and 4 for referenced roadway standards, street cross sections, and design parameters.)

Purpose

The purpose of this manual is to:

- Provide simple and straightforward guidance on street design,
- Provide a process for community involvement in street design,
- Update County Standards and Details, and
- Streamline the roadway design and approval process by laying out clear expectations for roadway planning and design.

Applicability

This manual applies to all streets under County of Maui authority, including private roadways that must be designed to County Standards, or may be dedicated to the County in the future. It does not apply to roadways under State or Federal authority, although coordination is strongly encouraged between jurisdictions.

This manual applies to both the design of new roads and the retrofit of existing roads.

This manual is intended for:

- Property owners, developers, and design consultants to understand the County's expectations for roadway design at the onset and throughout project development,
- Planners, designers and engineers of County roadway projects and adjacent land uses to better plan, scope and design projects,
- Plan reviewers and decision-makers to review and evaluate projects based on established standards, and
- Community members, to provide a framework for participation and understanding of street projects.

Chapter 2: Reference Documents

Design and Engineering Standards and Guidelines

The County of Maui uses numerous Federal, State, and County design standards and guidelines when designing roadways. These standards and guidelines are noted below in the following tables, and shall be considered and incorporated into roadway design. Where guidelines conflict, or deviation is requested from these accepted guidelines, consult with the Engineering Division of the Department of Public Works.

This list will be reviewed and updated if needed by the Department of Public Works' Engineering Division. Current editions shall be used for all reference standards.

Table 2-1: Acronyms and Abbreviations in this Manual

Abbreviation	Meaning
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
ADT	Average Daily Traffic (volume)
ANSI	American National Standards Institute
COM	County of Maui
DCAB	Disabilities and Communications Access Board, State of Hawaii Department of Health
DPW	Department of Public Works
DPWED	Engineering Division, Department of Public Works
FHWA	Federal Highway Administration, United States Department of Transportation
HDOT	Hawaii Department of Transportation
HEPA	Hawaii Environmental Policy Act
HRS	Hawaii Revised Statutes
IES	Illuminating Engineering Society
IESNA	Illumnating Engneering Society of North America
ITE	Institute of Transportation Engineers
LOS	Level of Service
LED	Light Emitting Diode
MDOT	Maui Department of Transportation
NACTO	National Association of City Transportation Officials
NEC	National Electrical Code
NEPA	National Environmental Policy Act
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Transportation Safety Administration

MECO	Maui Electric Company, Ltd.
PROWAG	Public Right-of-Way Accessbility Guidelines
PTSA	Parent Teacher Student Association
ROW	Right-of-Way
RRFB	Rectangular Rapid Flashing Beacon
STIP	Statewide Transportation Improvement Program
TRB	Transportation Research Board
TREC	Transportation Research and Education Center for Portland State University

Table 2-2: Standards and Guidelines – Roadway Design

Document Title & Website	Relevance	Publisher
A Policy on Geometric Design of Highways and Streets https://bookstore.transportation.org/collection_detai l.aspx?ID=110	Roadway design	AASHTO
Maui County Code https://library.municode.com/hi/county_of_maui/codes/code_of_ordinances	Driveways, Access Management, Block Length	COM
Standard Details for Public Works Construction	Standard details	COM
Manual of Uniform Traffic Control Devices (MUTCD) https://mutcd.fhwa.dot.gov/	Signage, striping, other traffic control devices	FHWA
Traffic Control Devices Handbook http://ecommerce.ite.org/IMIS/ItemDetail?iProductC ode=IR-112A	Traffic control device design and layout	ITE
Traffic Safety Toolbox: a primer on Traffic Safety http://ecommerce.ite.org/IMIS/ItemDetail?iProductC ode=LP-279A	Traffic Safety	ITE
Urban Street Design Guide http://nacto.org/publication/urban-street-designguide/	Street and intersection design	NACTO
Traffic Calming Primer http://www.patnoyes.com/Library/TrafficCalmingPrimer.pdf	Traffic Calming	Pat Noyes & Associates
Roundabouts: An Informational Guide (NCHRP Report 672) http://www.trb.org/Publications/Blurbs/164470.aspx	Roundabouts	TRB
Highway Capacity Manual http://www.trb.org/Main/Blurbs/175169.aspx	Multimodal traffic operations evaluation	TRB

Table 2-3: Standards and Guidelines – Pedestrian Facilities

Document Title & Website	Relevance	Publisher
Guide for the Planning, Design, and Operation of Pedestrian Facilities https://bookstore.transportation.org/collection_detai l.aspx?ID=131	Pedestrian facilities	AASHTO
DCAB Interpretive Opinions http://health.hawaii.gov/dcab/facilityaccess/interpretive-opinions/	Pedestrian accessibility	DCAB
"Informational Report on Lighting Design for Midblock Crosswalks" (Publication No. FHWA-HRT-08-053) https://www.fhwa.dot.gov/publications/research/safety/08053/	Street lighting for pedestrians	FHWA
Hawaii Pedestrian Toolbox: A Guide for Planning, Design, Operations, and Education to Enhance Pedestrian Travel in Hawaii http://hidot.hawaii.gov/highways/files/2013/07/Pedest-Tbox-Hawaii-Pedestrian-Toolbox-Low-Res.pdf	Pedestrian facilities	HDOT
Designing Walkable Urban Thoroughfares: A Context Sensitive Approach https://www.ite.org/css/	Context sensitive solutions for major streets	ITE
Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) https://www.access-board.gov/guidelines-andstandards/streets-sidewalks/public-rights-of-way	Pedestrian accessibility	US Access Board

Table 2-4: Standards and Guidelines – Bicycle Facilities

Document Title & Website	Relevance	Publisher
Guide for the Development of Bicycle Facilities https://bookstore.transportation.org/collection_detai l.aspx?ID=116	Bike facilities	AASHTO
Urban Bikeway Design Guide http://nacto.org/publication/urban-bikeway-designguide/	Bikeway design	NACTO

Table 2-5: Standards and Guidelines – Lighting

Document Title & Website	Relevance	Publisher
IES DG-21-15 Design Guide for Residential Street Lighting https://www.ies.org/store/design-guides/designguide-for-residential-street-lighting/	Street lighting	IES
IES DG-19-08 Design Guide for Roundabout Lighting https://www.ies.org/store/designguides/roundabout-lighting/	Street lighting	IES
ANSI/IES RP-8-14 Roadway Lighting https://www.ies.org/store/recommended-practicesand-ansi-standards/roadway-lighting/	Street lighting	IES

Table 2-6: Standards and Guidelines – Drainage Facilities

Document Title & Website	Relevance	Publisher
Storm Water and Drainage Rules 1. Rules for the Design of Storm Drainage Facilities 2. Rules for the Design of Storm Water Treatment Best Management Practices 3. Storm Water Quality Best Management Practices and Maintenance Plan https://www.mauicounty.gov/1867/Civil-Construction-and-Inspection-Sectio	Drainage	COM
Urban Street Stormwater Guide http://nacto.org/publication/urban-streetstormwater-guide/	Stormwater management in street right-of-way	NACTO

Table 2-7: Standards and Guidelines – Transit Facilities

Document Title & Website	Relevance	Publisher
Maui County Bus Stop Planning and Design Services	Transit facility design	COM
Guide for the Geometric Design of Transit Facilities on Highways and Streets https://bookstore.transportation.org/collection_detai l.aspx?ID=133	Transit design	AASHTO
Transit Street Design Guide http://nacto.org/publication/transit-street-designguide/	Bus stops and street design for transit	NACTO
Transit Capacity and Quality of Service Manual http://www.trb.org/Main/Blurbs/169437.aspx	Transit design	TRB

Table 2-8: Standards and Guidelines – Landscaping

Document Title & Website	Relevance	Publisher
Maui County Planting Plan https://www.mauicounty.gov/DocumentView.aspx?DID=11115	Landscaping	COM

Environmental Review

In addition to design standards and guidelines, roadway projects must comply with relevant Federal and State environmental statutes. Projects that are considered “Federal undertakings” must comply with the National Environmental Policy Act (NEPA), the National Historic Preservation Act and other Federal requirements. “Federal undertakings” include projects with Federal funding, and in some cases, projects that require permits from Federal agencies. County projects must comply with the Hawaiʻi Environmental Policy Act (HEPA) as outlined in Hawaiʻi Revised Statutes (HRS) Chapter 343.

This manual does not change any of the current practices or policies regarding environmental review and compliance.

Other Agency Reviews

Along with review by multiple County agencies (such as the Departments of Fire and Public Safety, Planning, Police, Public Works, Transportation, and Water) roadway projects may be reviewed by other agencies, such as the Department of Health, Hawaiʻi Department of Transportation (HDOT), Disability and Communication Access Board (DCAB), and other State and Federal agencies. With the exception of Chapter 5, Transit, this manual does not change the current authority or process for project review by other agencies.

Chapter 3: Street Sections

3.1 Street Classifications

Roadway classification systems are important in that they establish required rights-of-way and design standards based on each road type. Traditional roadway classification systems are based on evaluating a number of factors, including the following:

- Number of access points (driveways, intersections, etc.);
- Regional vs. local service;
- Speed; and
- Vehicular volume.

The Maui County Code and Standard Details for Public Works Construction, collectively and hereinafter referred to as the "County Road Standards", includes four primary types of roadways as follows:

- Arterials
- Parkways
- Collectors
- Minor Streets

In addition to the County classification system, the Federal Highways Administration (FHWA) has a developed Highway Functional Classification System. This classification system is important as it defines which local roadways may be considered part of the Federal Aid Highway system and as such are eligible for Federal funding through the State Transportation Improvement Program (STIP). The relevant Highway Functional Classifications for Maui include the following:

- Principal Arterials;
- Minor Arterials;
- Major Collectors;
- Minor Collectors; and
- Local Road.

Two other roadway types that have been referred to in County documents are "Alley" and "Private Street". The County of Maui's subdivision ordinance lists "alley" as a road classification, but this is not listed in the County Road Standards as these are not typically transferred to the County. The County Road Standards state that "Private streets shall conform to the requirements of the public streets." Alleys may be designed similar to a dead end street in that they will be narrower and have the option of having sidewalks, but is considered as a design exception for Maui County and must be approved by the DPWED.

This Street Design Manual provides a contextual approach to replace the classifications found in the County Road Standards. The new system is based on the factors noted above in traditional classification systems, but also adds the additional consideration of adjacent land use, which was not considered previously. With this additional consideration, roadways will be designed not just to accommodate desired speeds and volumes of vehicles, but also functionally to support existing and planned adjacent land uses. For these purposes, the designation of a Main Street or Industrial Street is used to modify priority elements and change the preferred design. These changes should be made during planning processes with the help of the local community to insure that street design matches the local needs and improves equity in the community.

Each street under the jurisdiction of the County shall be classified based on the Street Design Manual Classifications noted below in Table 3-1. In addition, each County street shall be classified based on the FHWA Highway functional classification system to determine eligibility for Federal Aid Highway funding.

Table 3-1: Street Design Manual Classifications

Name	Definition / Function	Examples	Characteristics
Arterial	Provides regional mobility	Pi’ilani Highway Honoapi’ilani Highway Haleakala Highway Kuihelani Highway	Under HDOT jurisdiction, this manual does not apply
Major Connector / Parkway	Connects arterials and belt roads to towns, commercial districts, and industrial districts; Serves local and visitor traffic; May carry heavy truck traffic Fewer access points (driveways)	Pu’unene Avenue Ka’ahumanu Avenue Kahekili Highway Wailea Alanui Drive	Speed Range: 30-40 MPH Lanes: 2-5 Traffic Volume: High
Major Collector	Connects neighborhoods to commercial districts, major connectors and belt roads; Serves local access traffic and regional circulation; More access points (driveways)	Lower Main Street Waiale Road Maui Lani Parkway Hookele Street	Speed Range: 20-35 MPH Lanes: 2-3 Traffic Volume: Medium
Minor Collector	Serves mostly local traffic; Serves mixed use destinations (residential and/or commercial); Typically near or connecting to major collector streets; Sidewalks and on-street parking are required or desired.	Papa Avenue Lono Avenue Eha Street (From Waena to Imi Kala)	Speed Range: 20-30 MPH Lanes: 2-3 Traffic Volume: Low to medium
Main Street	Serves through and local functions; Typically found in town cores and village centers; High pedestrian volume.	Front Street Market Street South Kihei Road	Speed Range: 15-25 MPH Lanes: 2-3 Traffic Volume: Medium

Name	Definition / Function	Examples	Characteristics
Industrial Street	Serves industry and heavy commercial areas; Services larger vehicles.	Hukilike Street Alamaha Street Wakea Avenue (from Pu'unene Ave to Hana Highway)	Speed Range: 25 MPH Lanes: 2-3 Traffic Volume: Low to High
Country Road	Serves local traffic; Serves low-density development and agriculture; May not have sidewalks, but shall have shoulders for multimodal users if reconstructed.	Lower Kula Road Kokomo Road Kaupakalua Road	Speed Range: 20-30 MPH Lanes: 2 Traffic Volume: Low to Medium
Minor Street	Serves residential zoned areas; Local traffic.		Target Speed: 20 MPH Lanes: 2 Traffic Volume: Low

Table 3-2 & 3-2 compares the Street Design Manual Classification System to the County Road Standards classification system and FHWA Functional Classification respectively. Some of the new roadway types may have been classified as more than one road type when compared to the older system depending primarily on volume, speed and multimodal function.

Table 3-2: Street Design Manual Classifications versus County Road Standards

	Street Design Manual Classifications							
County Road Standards	**Arterial**	**Parkway**	**Major Collector**	**Minor Collector**	**Main Street**	**Industrial Street**	**Country Road**	**Minor Street**
Arterials	✓							
Parkways		✓	✓					
Collectors			✓	✓	✓	✓	✓	
Minor Street					✓	✓	✓	✓

Table 3-3: Street Design Manual Classifications versus FHWA Functional Classification

FHWA Functional Classifications	Street Design Manual Classifications: Arterial	Parkway	Major Collector	Minor Collector	Main Street	Industrial Street	Country Road	Minor Street
Principal Arterial	✓	✓						
Minor Arterial		✓						
Major Collector		✓	✓		✓	✓	✓	
Minor Collector				✓	✓	✓	✓	
Local Street					✓	✓	✓	✓

3.2 County Standard Street Sections

Typical roadway sections for each street type follow below. As shown, some street types have more than one section. The selection of a specific section will be based on several factors as noted below.

Sidewalks: Sidewalks may be required based on other documents, including the Maui County Code, Community Plans, Urban Design/Town Core Plans, Special Planning Area Plans, or community design charrette or process. Sidewalk width may also be established in these documents. In addition, the County Engineer may require sidewalks on other streets if they contribute to overall pedestrian safety and connectivity. Sidewalks may also be required as a condition of development.

Bicycle lanes: Bicycle lanes are required if designated in the Bike Hawai‘i Plan, Community Plan, Special Planning Area Plan or when determined needed as part of a community design charrette or process. In addition, the County Engineer may require bicycle lanes on other streets if they contribute to overall bicycle connectivity. Bicycle lanes may also be required as a condition of development. For street sections where bicycle lanes are shown as an option, bicycle lanes will generally be required when daily vehicle volumes are or are projected to be 2,000 vehicles per day or greater. See Chapter 4 for information on protected bicycle lanes and the context where they are appropriate.

Parking: On-street parking has many different configurations. Whether or not on-street parking is required, and the ultimate configuration of the parking, will be determined based on County Code, Community Plans, Urban Design/Town Core Plans, Special Planning Area Plans or as a condition of development.

Drainage: Curb and gutter may be required in some areas based on County Code or as a condition of development. Where a specific stormwater management system is not required, either curb and gutter or drainage swales may be used, provided that the stormwater management system meets other County standard requirements.

Turn lanes: Turn lanes and medians may be required as determined in Community Plans, Town Core/Urban Design plans, community design charrettes or similar processes, Traffic Master Plans, Traffic Impact Analysis Reports or other traffic studies. In addition, the County Engineer may require turn lanes if it is determined that they improve the functionality of the roadway(s).

Intersections: Intersection treatments are not specifically shown in the design sections but may be designated in Community Plans, Town Core/Urban Design plans, community design charrettes or similar processes, Traffic Master Plans, and as determined in Traffic Impact Analysis Reports or other traffic studies. In addition, the County Engineer may require specific treatements. See Chapter 4 for intersection design reference materials.

Pedestrian: Pedestrian crossings are not specifically shown in the design sections but may be designated in Community Plans, Town Core/Urban Design plans, community design charrettes, or as determined in Traffic Impact Analysis Reports or other traffic studies. See Chapter 4 for pedestrian crossing design reference materials. The Hawaii Department of Transportation's Hawaii Pedestrian Toolbox is a resource for highlighting the importance of people walking.

Transit: See Chapter 5 for transit standards.

The figures on the following pages provide new County Standard typical sections. Where roadway sections are provided in Community Plans, Town Core/Urban Design Plans, or Special Area Plans, the sections shown in those documents shall take precedence over the County roadway standard sections.

Design concepts developed through a community design process authorized or accepted by the Department of Public Works may be accepted by the County Engineer.

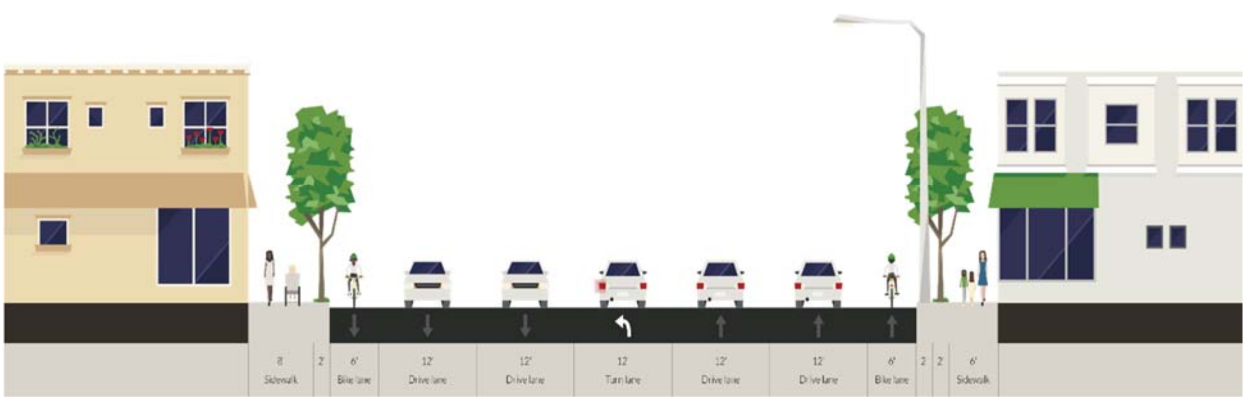
Due to right-of-way and other limitations, retrofit of existing streets may not be able to comply with the standard sections. In these cases, Department of Public Works will determine the appropriate street section to accommodate all roadway users to the greatest extent feasible, modeled after the street sections in this chapter but adjusted to fit the right-of-way constraints and other limitations. Justification for modified street sections should be documented in a letter or memo to be kept in the project file. See Chapter 7 for community involvement in the street design process.

All street designs shall consider how the right-of-way will be used by vehicles, bicyclists and pedestrians, and where applicable, transit (see Chapter 5 for transit standards).

Arterials

Arterial streets can be a significant barrier for people travelling in and around their community. While many of these streets are operated by Hawaii DOT, it is sufficient to say that Maui County can have input on how these streets are designed. Even though these streets have significant traffic volumes at peak hours and higher speeds, there are opportunities to improve these corridors for everyone using them. Adding a central median and separated bike lane to enhance the experience of the street and to reduce its overall width can be important. Removing barriers to crossing the street by adding beacons is also helpful for creating safe connections for active transportation.

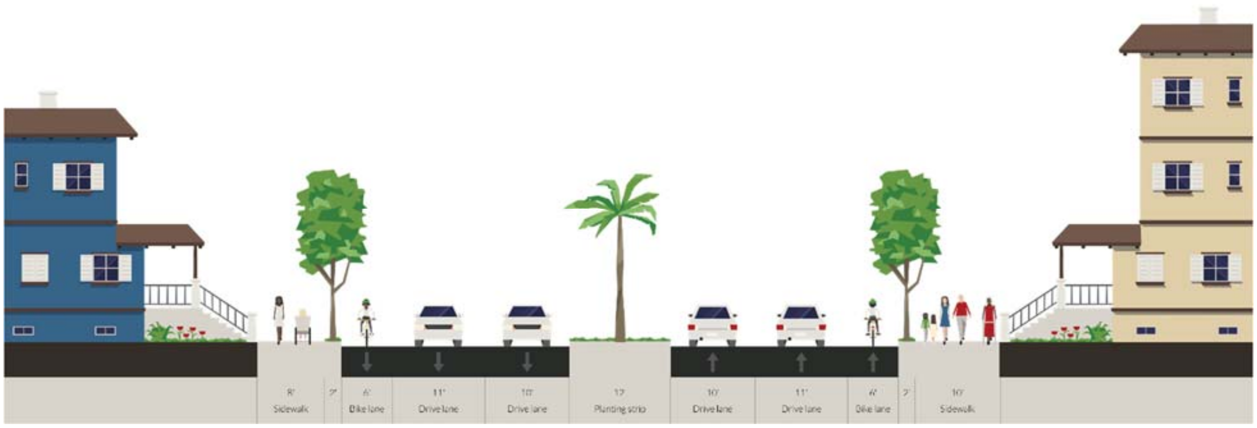
Figure 3-1: Arterial - Typical Cross Section (92-foot ROW)



Parkways

Parkways are similar to arterials but have an emphasis on the median which can be of varying widths. The parkway may serve limited access whereas arterials are less likely to provide that function. Parkways also have narrower travel lanes and are more likely to have bike lanes and wide sidewalks and have a maximum desired speed for 40 mph. General target speed is in range of 30-40 mph. Examples are Pu’unene Avenue, Ka’ahumanu Avenue, and Kahekili Highway, Wailea Alanui Drive. In County planning documents, parkways fall under major collector roadway types.

Figure 3-2: Parkway - Typical Cross Section (88-foot ROW)



Major Collectors

Major collectors should provide local access and regional circulation. This provides a difficult range of users in some cases. The existing cross section shown above may need to be widened to address the need for turn lanes and improved (potentially buffered or separated as shown below) bicycle facilities. Section 4 addresses cases where separated bike lanes may be appropriate depending on the speed and the level of traffic on the street. Major collectors can be a significant barrier for people walking if not designed with frequent crossings, especially at heavily used bus stops or locations with pedestrian activity.

Figure 3-3: Major Collector - Typical Cross Section (64-foot ROW)

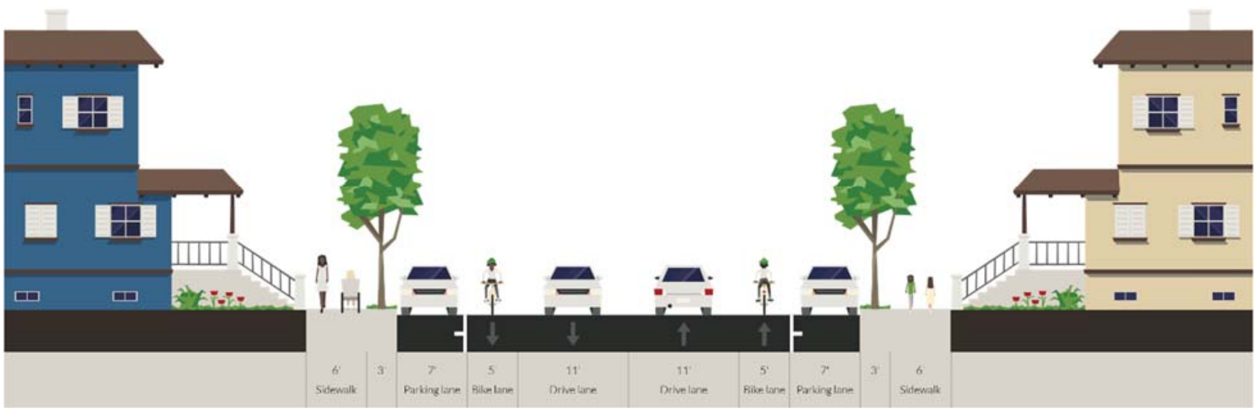


Figure 3-4: Major Collector - Typical Cross Section, parking one side (60-foot ROW)

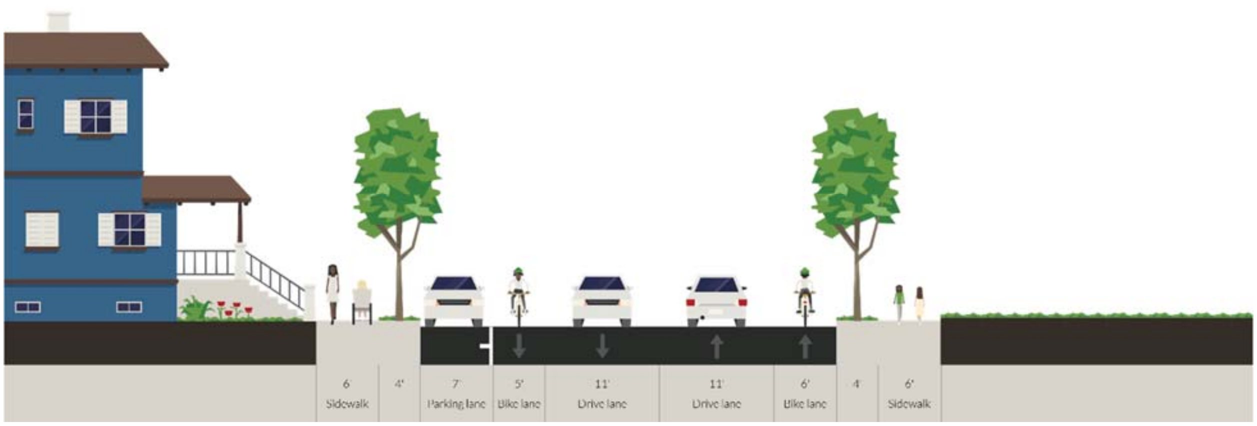
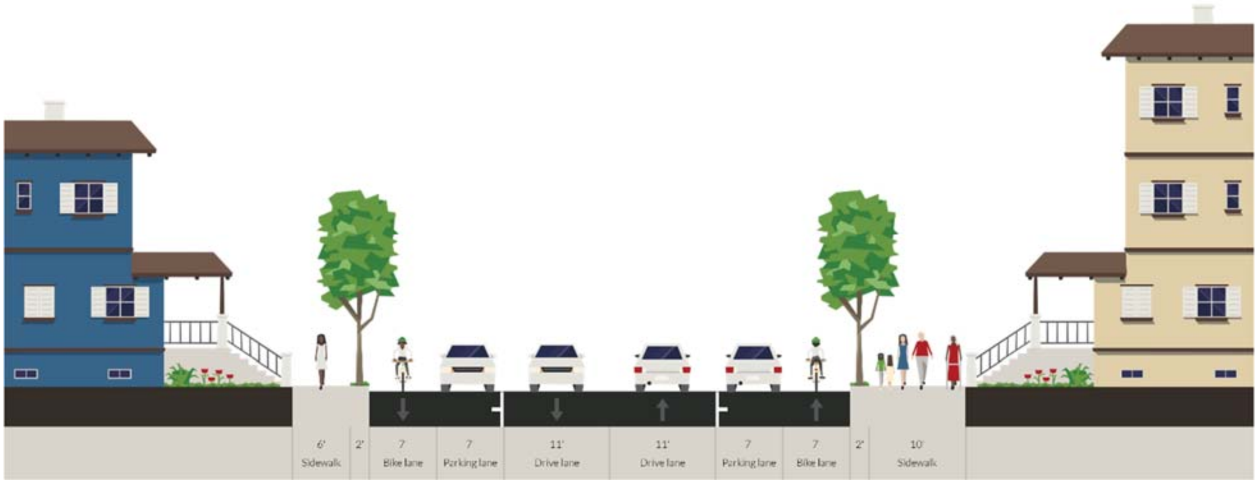


Figure 3-5: Major Collector - Typical Cross Section, Separated Bike Lanes (70-foot ROW)



Minor Collectors

Minor collectors should provide local access and area circulation. Bike lanes and parking are optional and can be used depending on context. These streets should provide safe and inviting places to walk with direct access to local stores and schools. While 6' sidewalks are shown in the example above, 10' is desirable adjacent to schools or in business districts where walking, street cafes, or other activity is likely. Design for local streets can combine stormwater management features, curb extensions, vertical speed control elements, and bicycle facilities that encourage safe speeds and attenuate through traffic.

Figure 3-6: Minor Collector - Typical Cross Section (56-foot ROW)

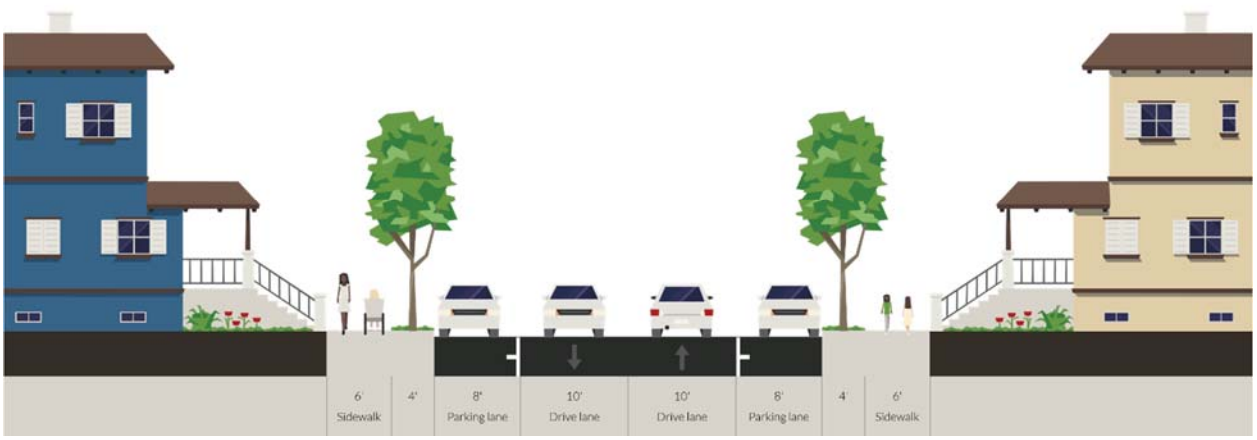
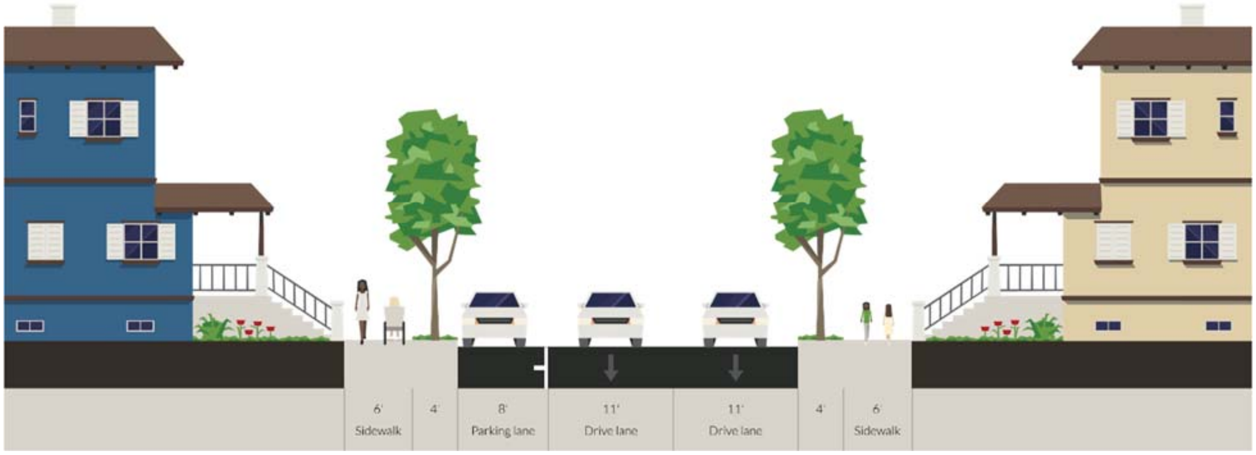


Figure 3-7: Minor Street - Typical Cross Section, Parking one side (50-foot ROW)



Minor Streets

Minor streets should serve local access and provide opportunities for walking and cycling. Speed of traffic is particularly important for recognizing when shared lanes for cycling are appropriate. Minor streets should incorporate traffic calming when necessary including planting in the buffer strip shown above. The provision of unimpeded 2-way traffic is not required in all cases as yield streets can be appropriate in residential environments where drivers are expected to travel at low speeds and give way to oncoming traffic depending on the use of traffic.

Minor (Local) streets should serve only local access and provide opportunities for on-street parking and walking. Desired speed of traffic is 20 mph, so the use of traffic calming is particularly important. This example is the absolute minimum and the maximum length of this street is 150’. Access for Public Safety and First Responders is particularly important where streets are as narrow as this.

Figure 3-8: Minor Street - Typical Cross Section, Parking both sides (50-foot ROW)

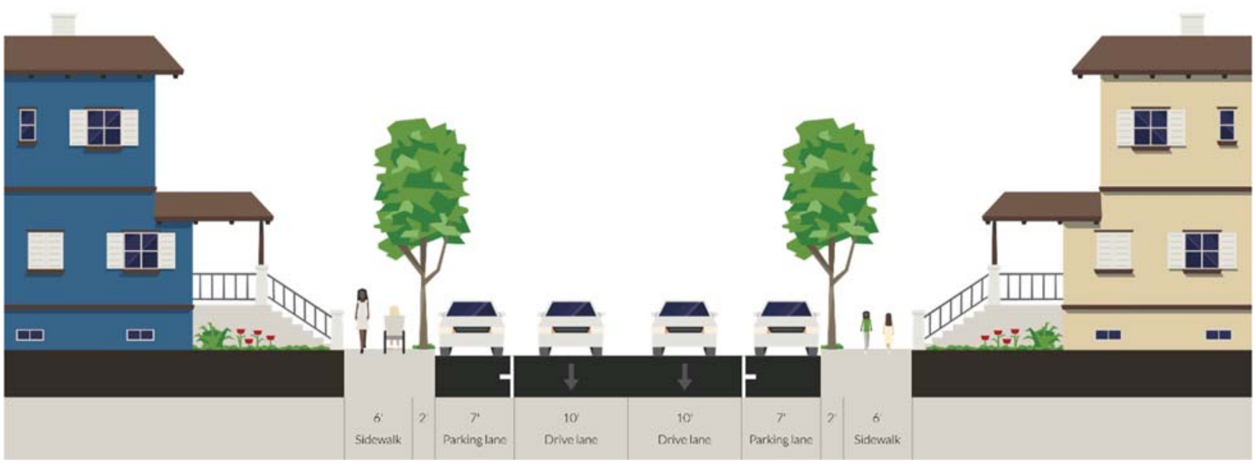


Figure 3-9: Minor Street - Typical Cross Section, Parking prohibited (44-foot ROW)

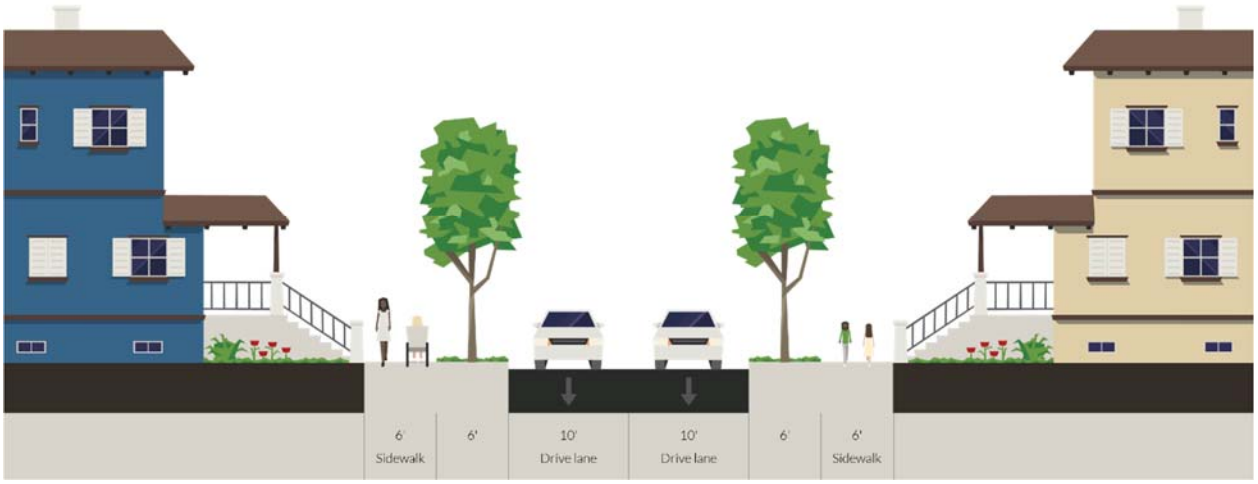


Table 3-4: Typical Widths (Minimum widths shown in parenthesis[1])

Street Classification	Vehicle Lane	Parking Lanes	Sidewalk	Bike Lanes[2]	Additional Information
Arterial	12 (11)	N/A	8 (6)	6	
Parkway	11 (10)	N/A	8 (6)	6	
Major Collector	11	7	6 (6)	5	
Minor Collector	10	8	6	5	
Minor Street	10-11	8	6 (5)	N/A	See Note 3
Main Street	11 (10)	8	10 (6)	6 (5)	See Note 4
Industrial Streets	12 (11)	8	6	6 (5)	
Country Road	11 (10)	N/A	N/A	5	See Note 5

Notes:

1. The use of minimum widths shall be reviewed and approved by the DPWED
2. Wider widths may be necessary depending on surrounding improvements, uses, and overall context. The DPWED will make the final determination on the appropriate bike facility.
3. Shared lane markings on minor streets may be used unless a different level facility is determined needed.
4. Depending on anticipated traffic, wider vehicle lanes widths may be required.
5. Parking lanes and sidewalks are not typical features of the Country Road classification. The appropriate

Chapter 4: Design Parameters

4.1 Design Speed

The selection of a design speed is the single most important choice designers will make because speed has a major influence on how people will use the street.[1] Speeds should be reevaluated as development occurs based on the presence of on-street parking, driveways, and adjacent land uses. A maximum speed of 35 mph is recommended in urban areas.[2]

Connectors outside of built-up areas may allow a higher target speed for the roadway. For connections between urban areas, a design speed up to 45 mph may be used if the geometric conditions allow. This speed is appropriate for longer distance trips around the island, especially where a reasonable alternative multimodal facility parallel to the Major Connector exists. Design speeds for highways owned and maintained by the Hawai'i Department of Transportation (HDOT) will be determined by HDOT staff.

Table 4-1: Design Speed and Design Vehicle Based on Street Classification

Street Classification	Design Speed	Design Vehicle
Arterial	As determined by HDOT	WB-50
Parkway	30-40	WB-50
Major Collector	35	WB-50
Minor Collector	30	WB-40
Main Street	20-25	To be determined
Dead End	20	SU
Industrial	25	WB-50
Country Road	30	WB-40
Minor Street	25	SU

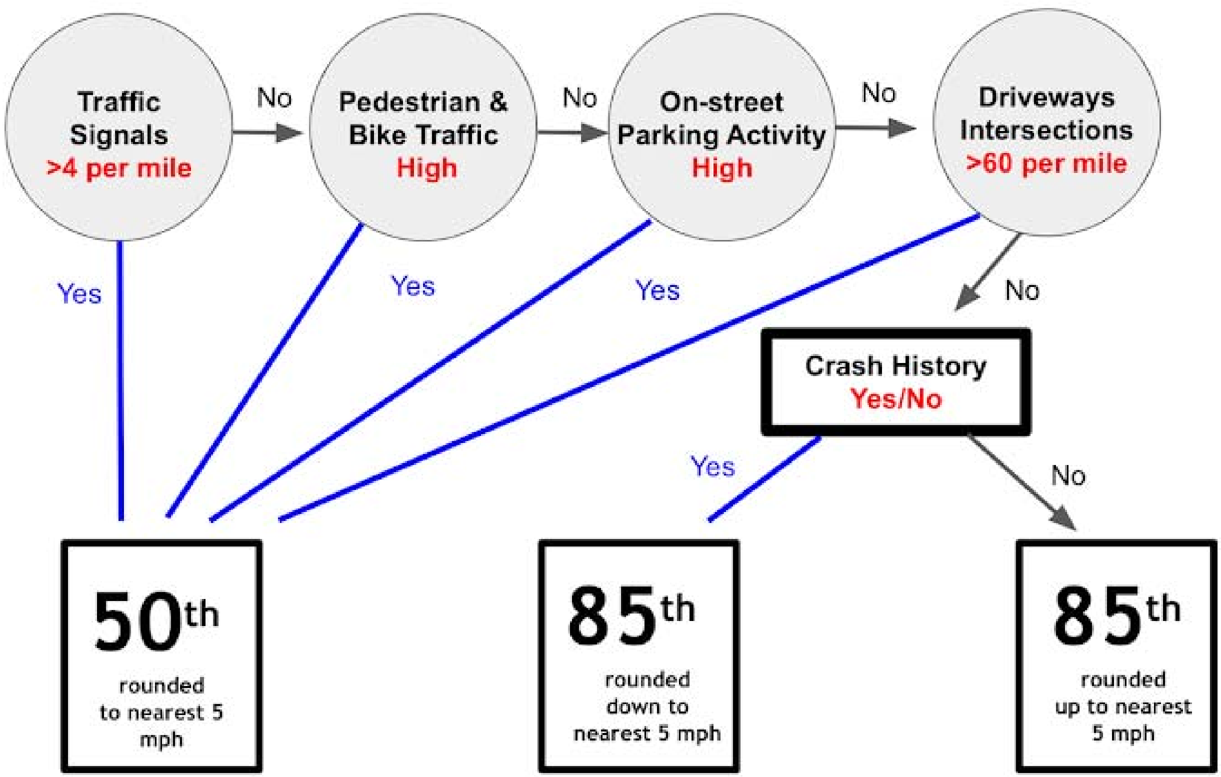
Notes:

1. Along bus routes on these streets, the design vehicle should be the either CITY-BUS for mainline bus routes or SU-30 for shuttle routes, to be determined by the transit agency.
2. The WB-50 vehicle approximates a truck pulling a 40-foot container; which is a common tractor-trailer combination on Maui.
3. The WB-62 vehicle approximates a truck pulling the low-boy trailers that are used to carry heavy equipment on Maui; these truck/trailer combinations are known to be the largest vehicles on Maui.
4. At intersections of two streets of different classifications, the smaller design vehicle and control vehicle should be used.
5. Table 4-1 assumes a maximum speed of 55 mph in level terrain for Arterial and 40 mph and slower for all other streets.

4.2 Speed Limits

State law establishes how speed limits should be set. In Hawaii, the maximum speed limit is established by county ordinance for County-owned streets or by the Director of Transportation for State-owned highways. For new streets, the speed limit should initially be set to equal the design speed. For existing streets, speeds should be set using a procedure based on the FHWA Report titled: *Methods and Practices for Setting Speed Limits: An Informational Report*.[3,4] The report is based on NCHRP Report 3-67.[5] Figure 4-1 summarizes the criteria to identify the appropriate speed limit for a roadway segment.

Figure 4-1: Speed Limit Setting Criteria



This method retains the 85th percentile speed as the preferred speed limit in less built up areas. In areas with more potential for conflicts, the posted speed will be lower than the maximum reasonable speed for driving under normal conditions, accounting for increased activity levels. The use of a 50th percentile speed reflects the importance and comfort of multimodal users on the street in denser areas.

Speed limits may be lowered from the above criteria based on engineering judgment after considering factors such as the design speed of horizontal curves, vertical curves, and intersection sight distance.

4.3 Design Vehicle

The design of streets and accompanying intersections is influenced by the assumed design vehicle and control vehicle. Table 4-1 summarized the recommended design vehicle per street classification. The design vehicle is what would be expected frequently on a street, making turns from a single lane to one or more receiving lanes. The control vehicle is a worst case scenario and may turn from multiple lanes, and may use opposing traffic lanes or the entire width of the roadway to complete a turn. The choice of control vehicle should be made on a per project basis. In industrial districts, larger vehicles and street design exceptions may be likely. Allowing the largest infrequent vehicles to use the whole intersection (moving into oncoming traffic lanes when making the turn) results in compact intersections. The compact nature of intersections (tight corner radii, narrower street cross sections, etc.) reduces turning speeds and improves safety for all users, especially pedestrians. Designers should consider removing parking spaces near the intersection or recessing stop lines to open up sight lines and reduce conflicts for large turning vehicles.

Geometric layout of corner radii shall consider the design vehicle for each intersection. The frequently experienced design vehicle should be accommodated without encroachment onto the curb and into opposing traffic lanes. It is generally acceptable for the design vehicle to encroach onto multiple same direction traffic lanes on the receiving roadway.

4.4 Access Control and Access Management

Access management is the design of access between roadways and land development to reduce conflicts on the roadway system.[6] Access management is accomplished through careful siting of driveways and medians on streets to focus turning traffic at fewer intersections. Access spacing standards are described in Table 4-2. Adjacent commercial properties should be encouraged to share driveways and parking to minimize the number of curb cuts.

Table 4-2: Access Spacing Standards by Posted Speed

Speed (mph)	Distance (feet)	Notes
20-25	100	
30	150	Medians on lower speed facilities for calming
35	200	
40	300	Medians should be considered at speeds >40 MPH
45	350	

Note: This table does not apply to residential streets or country roads.

Medians on streets can be constructed to limit turning movements, reinforce speed limits, provide a location for landscaping and stormwater management, and reduce the potential for crashes. The widths of medians may be as narrow as a 12-inch concrete (or plastic for retrofits) traffic separator to prohibit left turns or crossing movements. Medians must be 6 feet wide to serve as pedestrian refuge islands and wider if street trees or other amenities are desired. At intersections between two connector streets (major and minor), left turn lanes are required on both streets, unless roundabouts are used to control the intersection.

Any deviation or variance from the access management criteria requires an engineering study to be reviewed by County staff. If the street access deviation is adjacent to a state highway, the approval must be coordinated with HDOT prior to resolution of the deviation request. The analysis should evaluate impacts to the state highway system. When determining the need for and level of detail of an engineering study for a driveway, the following questions should be considered:
Do the proposed driveway(s) meet the minimum spacing requirements per Table 4-2?
Will the proposed driveway(s) require modifications to existing lanes?
Are there any multimodal safety improvement that should be implemented?
Are there any sight distance or physical obstructions that will result in a safety problem?

4.5 Driveways

The design of driveways requires a set of width, spacing, and frontage requirements. Driveway requirements depend on the land use and the type of street the driveway is intersecting with. The width of residential driveways should be a minimum of 10 feet and a maximum of 22 feet. Commercial driveways should be a maximum of 36 feet. The spacing of driveways is a function of the site frontage. When more than one driveway will serve a given property frontage, the total width of the driveways shall not exceed 60 percent of the frontage where such a frontage is 100 feet or less. Where the frontage is more than 100 feet, the total driveway width shall not exceed 50 percent of the frontage. Where more than one driveway is necessary to serve any one property, not less than 20 feet of full height curb shall be provided between the driveways.

Where sidewalks exist or will be placed, driveways should be constructed in concrete. Driveways should allow the sidewalk to continue at a consistent elevation and grade where possible and should not compromise the pedestrian experience. Where no sidewalks exist or are planned, the driveway may be either concrete or asphalt pavement. High volume commercial or multi-family residential driveways may be designed similar to street connections with corner radii, when approved by the County Engineer. At these locations, crosswalk markings shall be installed as described in section 4.8.3 of this chapter.

4.6 Sight Distance

Sight distance is a concept that is used for both highway design and for intersections. Sight distance is most commonly defined as the continuous length of roadway ahead visible to the user. Intersection sight distance is the distance required for a road user without the right of way to perceive and react to the presence of conflicting vehicles and pedestrians. Sight distance is an important issue associated with the safety of intersections, driveways, and other conflict points.[7] It is important to consider sight distance with high speed facilities. The use of sight distance to address where parking and other obstructions will be placed will suggest removal of objects such as street trees and other street furniture. The removal of these items may exacerbate the issues associated with higher speed traffic.

On residential streets and in other slow-speed environments, on-street parking is generally accepted within intersection sight triangles. For residential streets and country roads, parking should be set back a minimum of twenty (30) feet from any marked crosswalk or the prolongation of the right-of-way line of the intersecting street. For all other street classifications where parking is allowed and the speed limit is twenty-five (25) mph or less, parking setbacks for minor intersections and driveways should be a minimum of 25 feet for sight distance to the right and a minimum of 40 feet for sight distance to the left. For major intersections and driveways, parking may be allowed within intersection sight triangles based on engineering judgment on a case by case basis.

Intersection sight distance for higher speed streets (25 mph and above) should follow the procedures of the AASHTO Green Book.[8] Sight distance calculations using the appropriate Cases A through F for sight distances at intersections are appropriate.

4.7 Horizontal and Vertical Alignment

The alignment of roadways establishes the location of the public right-of-way. The horizontal and vertical alignment should provide sufficient sight distance on curves to allow the driver sufficient brake reaction time. Posted speeds may be lower than the design speed because of the limiting radius and other obstructions.

Super elevation and spirals should be used on roadway designs for Major Connectors with design speeds 40 mph and higher. The AASHTO Green Book recommends considering super elevation where curves have “an unacceptable history of curve related crashes.” All other streets have no required super elevation as summarized in Table 4-3.

Table 4-3: Minimum Radii Streets (No Superelevation) AASHTO Table 3-13b

Design Speed (mph)	Radius (feet)
15	47
20	99
25	181
30	300
35	454
40	667
45	900

Compound curves should be avoided. Properly designed vertical curves should provide adequate sight distance, safety, good drainage, and a pleasing appearance. The length of vertical curves should be greater than 100 feet and less than one-half mile.

4.8 Intersections

Intersection design should facilitate safety, visibility, predictability, and convenience for all users. Safety, efficiency, cost of operation, design context, and current and future users should be considered during intersection design.

A roundabout alternative shall be considered when rehabilitating existing intersections that have been identified as needing major safety or operational improvements. Evaluation shall also be required for all other types of projects that propose new signalization or require a change in an un-signalized intersection control. Evaluation is not required for minor operational improvements.

New traffic signals or four-way stop controlled intersections are discouraged. Roundabouts are the preferred treatment for intersections that cannot be adequately controlled by one-way or two-way stop control.[9] The Highway Capacity Manual[10] procedures should be used and intersections should be designed for the peak hour of flow rather than peak 15 minutes (use a Peak Hour Factor of 1.0). The Level of Service (LOS) standard for intersections is LOS “E” in town centers and LOS “D” in less densely populated areas for the peak hour of traffic.

Designers can use a wide range of intersection design elements in combination to provide both operational quality and safety. These include:

- Intersection control treatments such as roundabouts, stop signs, traffic signals, etc.;
- Traffic islands to separate conflicting vehicle movements and provide refuge for pedestrians;
- Full or partial street closures or roadway realignments to simplify the number and orientation of traffic movements through an intersection; and
- Separate turn lanes to remove slow moving or stopped vehicles from through traffic lanes.

The following sections provide a summary of primary intersection design guidelines.

4.8.1 Roundabouts

Modern roundabouts are effective in both safety and efficiency for pedestrians and bicyclists, as well as motor vehicles. Except as described below, a roundabout shall be used at any location where the MUTCD signal warrants or all-way stop control warrants are met.

Exceptions to this requirement are as follows:

- Where the intersection is immediately adjacent (less than 500 feet) to a coordinated signal system,
- Where a signal will be installed for emergency vehicle access, or
- Where steep terrain or ROW constraints would make construction more expensive or infeasible.[11]
- An all-way stop can be used as an interim measure to address safety concerns at an existing two-way (or one-way) stop controlled intersection.

Unlike traffic signal control, there are no warrants for roundabouts currently included in the MUTCD. Each roundabout must be justified on its own merits as the most appropriate intersection treatment alternative.

Geometry plays a significant role in the operational performance of a roundabout. The layout affects the speed of vehicles through the intersection, thus influencing their safety by virtue of the potential for conflicts that result in significant crashes. This is the result of the geometry and the extent that vehicles are forced to slow through the intersection, which is effective throughout the entire day. This is especially important for people walking and cycling as slower vehicle speeds suggest it is likely that appropriate yielding will occur.

The widths of the approach roadway and entry design also determine the way the vehicles will interact in the intersection. For the situations with two lanes circulating the roundabout, vehicle streams form side-by-side and the rate at which vehicles may enter the circulating roadway can be affected by the degree to which flow in a given lane is facilitated or constrained. In summary, the geometric elements of a roundabout, combined with the volume of traffic desiring to use a roundabout will determine the safety and efficiency of the roundabout operation.

Crossing at multilane roundabouts is more difficult for all pedestrians, but especially for the more vulnerable users. Multilane roundabouts have longer crossing distances and pedestrians need assurance that all lanes are free of moving traffic before they can cross the street. Recent research indicates that two to three times more motorists do not yield to pedestrians at multilane roundabouts
than at single-lane roundabouts. In addition, pedestrians are faced with multiple-threat crashes when the driver in the first lane stops to yield to a pedestrian, blocking the sight lines between the pedestrian and any vehicles in the next lane. In these cases, beacons should be strongly considered for the crossings to ensure safe crossing for people walking.

Bicyclist decisions at roundabouts depend on how the bicyclist chooses to travel through the intersection. If traveling as a vehicle, as is often the case for experienced cyclists and cyclists in lower volume and speed environments, the decision process mirrors that of motorized vehicles. If traveling as a pedestrian, as is often the case for less experienced cyclists and cyclists in higher volume environments, the decision process mirrors that of pedestrians. Care must be taken to ensure paths for pedestrians allow for safe crossings for people on bicycles. The accessibility of crossings must be carefully considered for users in wheelchairs or with devices that assist with mobility.

4.8.2 Traffic Signals

New traffic signals shall only be used at locations described in the exceptions above. Traffic signals should include pedestrian crossings at all legs of the intersection.

A warrant is a condition that an intersection must meet to justify a signal installation. The Manual on Uniform Traffic Control Devices (MUTCD) specifies the conditions where traffic signals or roundabouts are recommended. The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal (MUTCD, 4C.01). The final decision is made based upon the DPWED's judgment. The traffic engineer analyzes vehicle traffic volume, pedestrian activity, intersection crash history, the physical environment, and other factors in order to determine whether or not an intersection proceeds with or warrants a traffic control signal.

Engineers examining the intersection may review the following:

- Number of vehicles entering the intersection from all directions during 4-hour and 8-hour periods
- Vehicular volumes during peak hours, classified by vehicle type for traffic movement in all directions
- Pedestrian volume on each crosswalk in all directions, including children, the elderly, and/or persons with disabilities, during each hour of the day
- Requests from participants attending nearby facilities and activity centers that serve the young, elderly, and/or persons with disabilities
- Posted speed limit
- Physical layout
- Crash experience/history
- Different warrants require detailed analysis of different aspects of the above information
- Surrounding roadway network

4.8.2.1 Signal Phasing

There are five options for the left-turn phasing at an intersection: permissive only, protected only, protected-permissive, split phasing, and prohibited. Phasing can have a significant impact on signal system effectiveness for a number of reasons, including:

- Permissive only left turn operation may reduce delay for the intersection, but may affect intersection safety, because it requires motorists to choose acceptable gaps.
- Protected only left-turn phases may reduce delay for turning vehicles but are likely to increase overall intersection delay.
- Protected-permissive left turn phases can offer a good compromise between safety and efficiency but could limit available options to maximize signal progression during coordination unless innovative displays are used.
- Split phasing may be applicable with shared lanes, but could increase coordinated cycle length if both split phases are provided a concurrent pedestrian phase.
- Prohibited left turns may be used selectively to reduce conflicts at the intersection.

A permissive turn is made across an opposing flow of through vehicles and/or pedestrians. This is typically denoted for motorists by a circular green (green ball) signal and allows a user to cross the opposing through flow after accepting an appropriate gap in the opposing traffic stream through which to turn. The driver must also yield to pedestrians and cyclists who are crossing lawfully within the intersection. This is where crashes must be carefully monitored to insure an effective control decision is made. This is the most common type of left-turn phasing at signalized intersections and is used both when left-turn volumes are not excessive and where adequate gaps of sufficient size exist in the opposing traffic to accommodate turns safely.

A protected turn is made without opposing through vehicular traffic or pedestrian crossing. Protected signal phasing is typically activated by a vehicle detector and the signal phasing "protects" vehicles by prohibiting the opposing movements, including pedestrian movements. Protected turns require a separate signal phase, which leads to multiphase signalization (more than two phases at the intersection)

Protected-permissive operation represents a combination of the permissive and protected modes. Left-turning drivers have the right-of-way during the protected left-turn phase. They can also complete the turn "permissively" when the adjacent through movement receives its circular green indication, or more commonly now as a flashing yellow arrow. This mode provides for efficient left-turn movement service, often without causing a significant increase in delay to other movements. This mode also tends to provide a relatively safe left-turn operation and all new and upgraded signals shall incorporate the flashing yellow as allowable depending on speed of the facility and the priority users on the street (care must be taken when high volumes of bicylcle and pedestrian traffic are present).

Split phasing provides separate green time to vehicles on opposing approaches. In split phasing, the northbound and southbound through movements do not operate simultaneously. At offset intersections and locations where there are heavy turn movements, split phasing may be used to allow movements on each approach to move independently of other approaches. Pedestrian phases for parallel crosswalks may be activated at different times. The pedestrian phase for a crosswalk will coincide with the through traffic movement immediately adjacent to that crosswalk.

4.8.2.2 Accessible Pedestrian Signal Guidance

The 2009 MUTCD recommends and the Proposed PROWAG (Reference) requires accessible pedestrian signals (APS) to be located at the pushbutton (pushbutton-integrated) to enable use of the vibrotactile feature. The installation location requirements are described in detail in the aforementioned documents. The most common application of APS are integrated into the pushbutton. APS units are now set up to include a single tone because the standardized location of the pushbutton-integrated speaker in relation to the crosswalk provides information about which crosswalk has the WALK interval. Pedestrians beside the appropriate APS will hear the message and ideally it would be at sufficient distance from the APS for another crosswalk. Speakers located in this manner are now included in the 2009 MUTCD. APS shall be installed in new and upgraded signals in commercial and industrial areas.

4.8.2.3 Detection

All new and upgraded signals shall utilize detection hardware that allows for the detection of bicycles on all actuated approaches.

4.8.3 Pedestrian Crossings

Crosswalks shall be marked on all approaches to intersections that are controlled by a yield sign, stop sign, or traffic signal. Engineering judgment should be used to determine where crosswalks are marked at uncontrolled intersection approaches and midblock locations, as an important part of the pedestrian network. At uncontrolled and midblock locations, supplementary signs should be used in addition to signs installed at the warning signs installed at the right edge of the roadway. When marked, crosswalks shall have lines that are longitudinal to the roadway (sometimes called “continental markings”) that are spaced to avoid the wheel paths of vehicles. The NCHRP 562 guidelines[12] should be used to identify when enhanced crossings (median refuge, flashing beacons, and advanced stop lines) will be used. Techniques to reduce crossing distances shall be considered such as:

- Pedestrian refuges and medians
- Curb extensions and bulb-outs
- Reduction in the number of travel lanes

4.8.3.1 Accessible Curb Ramps

Significant progress has been made installing curb ramps on pedestrian facilities and Maui County is committed to continuing this progress. The County will require the construction of new ramps and improving or replacing existing ramps that no longer meet standards during all permits and construction projects. The highest priority is in response to citizen requests regarding missing curb ramps or those in place that essentially still present a barrier. There are also high priority locations where disabled persons use public transportation and on ‘critical corridors,’ as identified by the community. The next highest priority are town centers that typically see higher pedestrian traffic generally as well as due to the presence of public transportation.

4.8.3.2 Rectangular Rapid Flashing Beacons

Rectangular Rapid Flashing Beacons (RRFBs) are used to provide active warning to motorists that pedestrians are crossing at marked crosswalks. If overused, RRFBs could potentially lose their effectiveness. RRFBs should be reserved for use on higher volume, and/or higher speed streets.

The following guidelines should be used for selection of locations for installation of RRFBs:

- RRFBs shall only be used at marked crosswalks with existing pedestrian crossing warning signs.
- RRFBs shall only be installed on functionally classified urban collector or higher roadways. RRFBs should not be installed on streets classified as residential streets.
- Roadway shall not have a posted speed limit greater than 30 miles per hour.
- 85th percentile speed shall not exceed 45 miles per hour.
- RRFBs should not be installed on other streets with less than 2,000 vehicles per day, except within school zones, based on engineering judgment.
- Stopping sight distance based on the 85th percentile speed, must be available to the crosswalk pavement markings.
- At crosswalks where the crossing distance is greater than 36 feet, every effort should be made to install a raised median island and a three RRFB system.
- RRFBs shall not be considered in the following locations:
- Within the operational area of a signalized intersection;
- At a stop-controlled approach;
- On a classified urban collector primarily serving a residential area or functioning in a local access capacity;
- Within 200 feet of an existing and separate RRFB installation.
- RRFBs are generally not necessary for single-lane roundabout approaches, due to slow speeds, the short crossing distance, and the presence of a median for pedestrian refuge.

Prior to consideration of an RRFB, crossing location improvements should be implemented and the effectiveness of such improvements shall be monitored for an appropriate period. Such improvements may include:

- Restriping of the pedestrian pedestrian crossing
- Additional, larger, or replacement of crossing warning signs
- Evaluation and increasing of pedestrian-driver sight lines
- Bulb-outs

4.8.4 Angle of Intersection

A right-angle intersection provides the shortest crossing distance for intersecting streets. Intersections should not be skewed more than 15 degrees from a right angle if possible. Skew angles of 75 degrees or less may need geometric countermeasures, such as channelization or other traffic control, such as roundabouts.

4.8.5 Corner Radii and Curb Extensions

Small corner radii keep intersections designs compact and crossing distances short. However, if corner radii are too small, operational problems can occur for larger vehicles. At the intersection of two streets of different classification, the smaller required radius will control. The radii should be smaller if there is a bike lane, parking, or other width that provides a larger “effective” radius. Larger radii should only be used if vehicle tracking software or another method shows that a larger radius is necessary for the design vehicle and control vehicle as specified in Section 4.3.

On all curbed streets where parking is allowed, curb extensions (also known as bulb-outs) should be used at intersections and marked crosswalks, except on industrial streets. For curb extensions at parallel parking the curb should be offset six feet from the normal curb, and for curb extensions at diagonal parking the curb should be offset 13 feet from the normal curb. Where curb extensions are used, consideration should be given to sloping the surface of the parking area toward the center of the road with a valley gutter located in line with the gutter at the curb extensions.

4.9 Traffic Control Devices

Traffic markings, and other devices used to regulate, warn, or guide motorized and non-motorized traffic are covered in this section. All traffic control devices placed on or adjacent to County streets, pedestrian facilities, or bicycle facilities shall be in substantial conformance with the standards and guidelines within the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).

4.9.1 Center Line Markings

Center line markings shall be placed on County streets at locations identified in Table 4-4. In addition, center line markings should be placed on other streets where an engineering study indicates such a need. Center line markings shall be used on any street or portion of a street with three or more lanes for moving motor vehicle traffic, including turn lanes. Where center line markings are used, solid double yellow markings indicating no passing zones shall be used, except that passing zone markings may be used on major connectors and major collectors where an engineering study has determined that available sight distance and other features allow for passing zones (See MUTCD Section 3B.02). Where an engineering study indicates a need for a two way left turn lane, two-way left turn lane markings may be used instead of double yellow markings.

Table 4-4: Center Line Markings

Street Classification	Average Daily Traffic Volume (ADT)	Center Line Marking Requirement
Major Connector	All Volumes	Continuous center line, median, or turn lane
Major and minor collectors	ADT > 3,000	Continuous center line
	1,000 < ADT < 3000	Center line for 50 feet approaching all intersections and at horizontal and vertical curves that restrict sight distance
	ADT < 1,000	Center line for 50 feet approaching all intersections
Country Road	ADT > 1,000	Center line for 50 feet approaching all intersections
	ADT < 1,000	Center line for 50 feet approaching stop signs
Industrial	All Volumes	Continuous center line
Main Street	All Volumes	Continuous center line
Minor Street	All Volumes	Center line for 50 feet approaching stop signs

4.9.2 Edge Line and Bicycle Lane Markings

The following standards and guidelines apply to edge line markings:

- Edge line markings shall be used on all uncurbed major connectors and other uncurbed roadways with average daily traffic of 6,000 vehicles per day or greater.
- Edge line markings should be used on all other uncurbed roadways with average daily traffic of 3,000 vehicles per day or greater.
- Where bicycle lanes are marked, the bicycle lane line provides the necessary delineation of the traveled way for motor vehicle traffic; edge line markings on the outside of the bicycle lanes are not necessary.
- Bicycle lanes should be marked with white lines that are six (6) inches wide and the helmeted bicyclist symbol shown in Figure 9C-3B of the MUTCD. Bike lane signs are not necessary to supplement bicycle lane markings, and should generally be avoided to reduce sign clutter.
- Raised pavement markings should not be used to supplement edge lines or bicycle lane lines.

4.9.3 Stop Lines

The following guidelines shall be applied for the installation of stop lines.

- Stop lines shall be used to supplement all stop signs and traffic signals. Stop lines should normally be placed 5 feet in advance of crosswalks at stop signs and traffic signals.
- Stop lines should be used in advance of marked crosswalks at uncontrolled locations, as follows:
- For approaches to crosswalks with only one through lane, stop lines should be placed 10 feet in advance of the crosswalk markings. If there is a two-way left turn lane or

dedicated left turn lane adjacent to the single lane, then the stop line should be extended across the left turn lane. Stop lines should be placed further in advance of crosswalks if placement at 10 feet would result in the stop line being placed in the middle of an intersection.

- For approaches with more than one through lane in the same direction, stop lines should be placed 20 to 50 feet in advance of the crosswalk markings (30' preferred).
- If stop lines are used, the STOP HERE FOR PEDESTRIAN (R1-5) shall be used.
- Stop lines should not be used in advance of crosswalks at roundabouts.
- Except at locations where stop lines are required or recommended above, stop lines shall not be used within left turn lanes.

4.10 Traffic Calming

Traffic calming is the use of physical measures that reduce traffic speeds to create safer, more comfortable streets for residents and users. Traffic calming measures are intended to be self-enforcing changes to reduce traffic speeds.[13] The three types of speed control measures are: vertical measures, such as speed humps or speed cushions to make higher speeds less comfortable for drivers; horizontal measures, which require lower speeds to navigate; and narrowing measures, which use a sense of enclosure to discourage speeding. Traffic calming is often implemented as a retrofit to a street, in conjunction with other changes.[14] Traffic calming may also be employed on bicycle boulevard projects that promote connectivity for bicyclists.

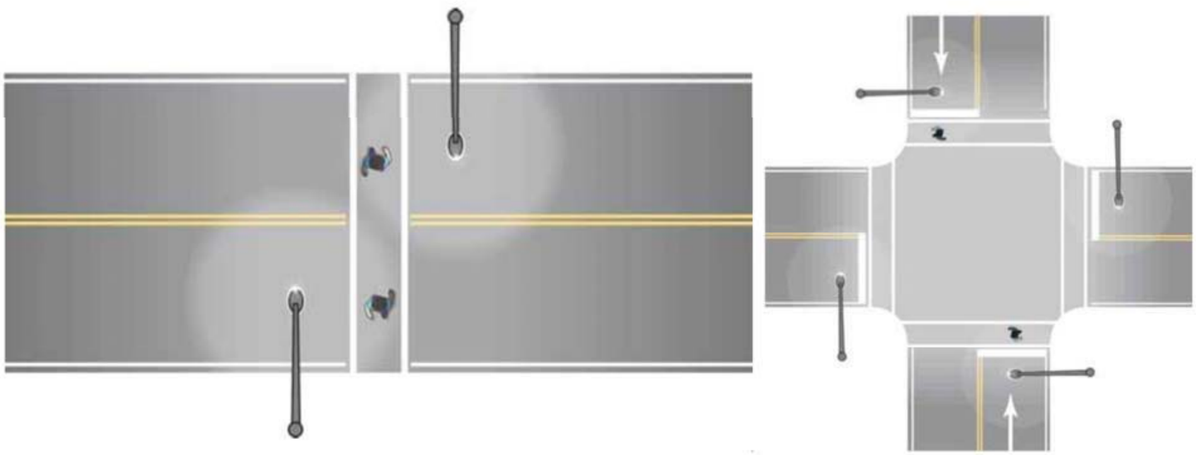
4.11 Street Lighting

Street lighting is a key organizing streetscape element that defines the nighttime visual environment in urban settings. Lighting design should assess conditions for vehicular traffic and pedestrians on sidewalks. On streets with lots of trees, street lighting scaled to pedestrians (low lights) illuminates the sidewalk even after the trees grow larger. Lighting can also be helpful along streets adjacent to the school grounds to minimize school vandalism and improve security. Transit stops benefit from both kinds of lighting: illumination of the travel way for safer walking conditions, and illumination at the stop or shelter for security.

The design of all lighting systems should be in conformance with the National Electrical Code, the National Electrical Safety Code, and Hawaii State Electrical Code. Luminaires shall be Light Emitting Diode (LED); weatherproof aluminum housing and should have zero up light and shall be consistent with mitigation and conservation plans for protection of endangered species. The mounting height will vary depending on the adjacent utility poles, wattage of the street light, type of area, and the spacing between poles. Street lights on Maui that are connected to the power grid are maintained by the Maui Electric Company (MECO). Therefore, all street lights shall meet the current requirements and installation approval processes of the County of Maui and MECO. The provision of lighting should be carefully weighed with concerns from the community.

4.11.1 Crosswalk lighting

Marked crosswalks should have street lights that illuminate the pedestrian from all sides that vehicles may approach. Crosswalk lighting should meet the guidance provided in the Informational Report on Lighting Design for Midblock Crosswalks.[15]



Typical Crosswalk Illumniation Placement

4.11.2 Roadway lighting

Streetlights should be installed at intersections, cul-de-sacs, and at 400 feet intervals in new residential subdivisions. Streetlights should be installed and activated at intersections, cul-de-sacs, and at 300 feet intervals in new commercial or industrial subdivisions. Illuminating Engineering Society of North America (IESNA), *Roadway Lighting, RP-8-14* contains design criteria for street lighting.[16] Alternatives to this spacing may be considered by the County Engineer, based on a lighting study.

4.12 References

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- “Hawaii Pedestrian Toolbox: A Guide for Planning, Design, Operations, and Education to Enhance Pedestrian Travel in Hawaii,” Hawaii Statewide Pedestrian Master Plan (Honolulu: Hawaii Department of Transportation, May 2013), 2-15–18, https://hidot.hawaii.gov/highways/files/2013/07/Pedest-Tbox-Hawaii-Pedestrian-Toolbox-LowRes.pdf.
- Reid Ewing, *Traffic Calming: State of the Practice* (Washington, D.C.: Institute of Transportation Engineers, 1999), http://www.ite.org/traffic/tcstate.asp.
- Ronald B. Gibbons et al., “Informational Report on Lighting Design for Midblock Crosswalks” (McLean, VA: Federal Highway Administration, April 2008), https://www.fhwa.dot.gov/publications/research/safety/08053/. [16] *ANSI/IESNA RP-8-14 American National Standard Practice for Roadway Lighting* (Illuminating Engineering Society, 2014).

Chapter 5: Transit

The County of Maui Department of Transportation (MDOT) oversees and operates the Maui Bus. The following guidelines shall be used for the routing of project applications to the Transportation Agency for review and comment.

Planning Department

- Zoning permit applications for the following types of projects shall be routed to the MDOT prior to conditions of development being reviewed and approved by the Planning Commission or the Planning Department;
- Projects fronting an existing bus route;
- Projects on a proposed bus route as identified in planning documents such as Community Plans;
- Schools;
- Parks of two acres or greater;
- Senior housing projects with four units or more;
- Housing projects with eight units or more;
- Commercial projects with a minimum of 10,000 sf of building space;
- Medical projects with a minimum of 5,000 sf of building space;
- Industrial projects with a minimum of 10,000 sf of building space; and
- Resort projects

Department of Public Works Engineering Division

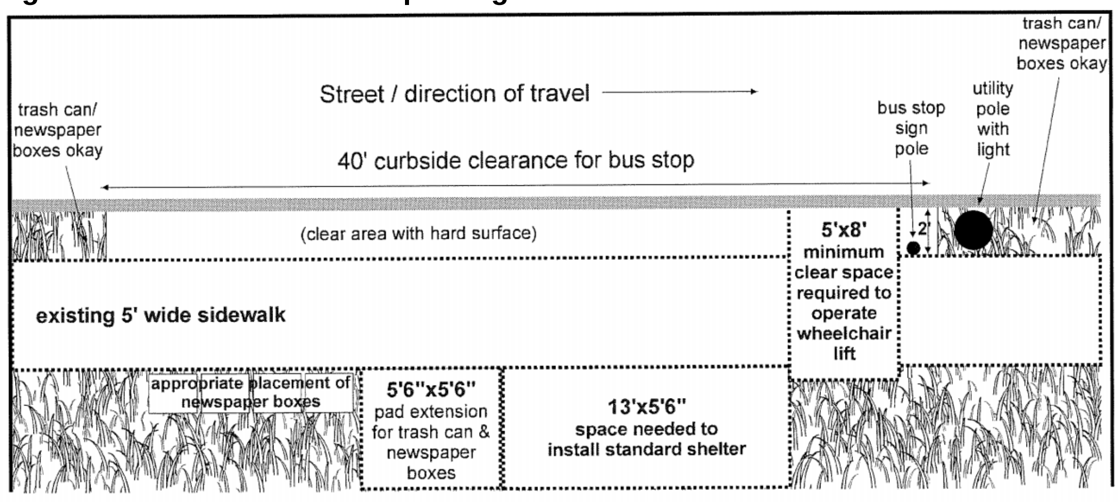
- All Road projects shall be routed to MDOT at the scoping and conceptual design phase.
- Additional phases may be submitted to the Transportation Agency depending on the scope of the project.

Transit Design Guidelines

Where transit facilities are required, they shall be designed based on the *Maui County* Bus Stop Planning and Design Services report.The report describes guidelines for how bus stops should be implemented. The document highlights the importance of designing to meet the Americans with Disabilities Act (ADA) and Access Board proposed requirements. To meet minimum accessibility standards, a wheelchair lift must be usable at the stop and an accessible landing area must be constructed. To provide for rear-door alighting from the larger heavy-duty buses, the landing area should ideally be 30 feet long for stops served by 40-foot buses. A 4-foot wide clear path must be provided for access to any elements such as shelters or informational displays, and any interactive elements such as street lighting poles or traffic signal push buttons. Signage must be positioned at a height at least 80 inches from the ground and letters and numbers should be at least 3” tall to insure readability.

The Bus Stop Planning and Design Guide requests a 13’ by 13’6” concrete pad for an optimal accessible layout. There is a recognition that variations may be necessary due to limited right of way and the slope of the street. Shelters can be oriented open to curb (typical); with its back towards the curb; at the building-side of the sidewalk. Ideally, a pedestrian through-zone on the sidewalk is maintained, behind or in front of the shelter, in commercial and high-use settings. At the least, the placement of a shelter should maintain a minimum 5-foot sidewalk clear zone, which may be wider than the ADA standard (PROWAG §R302). The layout of the stop should account for door location of the vehicles used by Maui Bus. Trees and other vegetation can be integrated into the stop area outside of clear paths and accessible landing areas, providing shade and a more comfortable waiting environment. Passengers waiting in shelters must be able to easily see arriving transit vehicles and must be readily visible to operators. Clear zone must not overlap with the seating area, consisting of seat and a seating zone extending 1.5 feet in front of the seat (ADAAG §R308, 404). Shelters are shown as 4’8” deep.

Figure 5-1: Preferred Bus Stop Design for Shelter



Stop Spacing

The Maui Bus Stop Planning Guide suggests bus stops are spaced at intervals of less than 1,320 feet in low density urban areas, and no less than 600 feet along each route in high density areas. It is desirable to locate bus stops in close proximity of signalized intersections or other crosswalks to provide accessibility to both sides of the street. Adjacent land use is particularly important when considering the location of stop placement. In addition, the transfer of passengers between routes should also be considered when identifying near-side or far-side placement.

Use of Bus Stop Pullouts

The provision of bus stop pullouts is not considered desirable for bus operations by many agencies. However, due to the range of streets on the island, there are some cases where pullouts for bus stops may be desirable. The Bus Stop Planning and Design Guide suggested that buses should not stop in the travel lane where dwell times are significant or on streets where speed limits exceed 35 mph. The Guide suggests that bus pullouts are at least 12 feet wide and it is important to provide ample space for taper lengths to insure buses can accelerate in order to merge back into traffic.

The following table highlights the basic elements the designer should consider for the bus stop.

Table 5-1: Bus Stop Design Standard Checklist

Issue	Specification / Description	Comment
Clear Space Along Curb Lane	Minimum: 30’ Prefer: 40’	Level with preference for pavement or concrete with clear space of minimum 4 feet wide.
ADA Landing Pad	5’ parallel to street, 8’ deep	Included in #1 above, should be connected to sidewalk and accessible ramps
Bus Stop Information	Include bus stop pole, flags, and schedule holders	Place 18 to 24 inches from curb line at the front of the bus stop.
Trash	Optional	Placed outside of clear space & ADA pad
Seating	Bench on pad or in shelter	Minimum of 4 feet from curb, insuring clear path for ADA
Vandalism Protection	N/A	Design to discourage vandalism Surface coatings should be anti-graffiti or allows easy removal
Electric	Solar power preferred, but also option of A/C power	120 V/20 Amp circuit considered for real-time passenger info, lighting of stop, etc.
Landscaping	Optional	Placed 3 to 4 feet back of curb line.
Traffic Protection	Used on >45 mph streets	Where passengers are >6 feet from curb line.
High Volume Stops	Extra space needed	Require 8-10 square feet per peak load passenger
Key Stops	Shelter area >200 square feet	Stops include lighting, displays, maps, transit info, etc
Lighting	Internal to shelter: 5-10 foot candles	Powered by solar energy
Shelters	Use standard designs	Insure ADA standards are met
Bus Stop Sign	Mount on shelter or pole	
Advertisements	Use signage standards	Shelter advertisements are not allowed
Neighborhood Zoning	Conform to neighborhood policies	Seek approval as necessary
Adopt-A-Stop	Allows adoption for shared maintenance	Recognized with plaque on shelter, etc.
Route to and from Bus Stop/shelter	Safe and Walkable	Routes between stop/shelter and neighboring developments should be walkable/accessible, promote biking to support connectivity.
Lighting – No shelter stops – route to and from development to shelter/stop	Rider is visible	Routes between developments and stops/shelters should be lighted so passenger is visible. Ample lighting is encouraged to promote walkable communities & for the safety of riders.
Street configuration	Optimal routes for transit	Route expansions are dependent on through streets. It is encouraged that developments prioritize through streets over cul-de-sacs.

Chapter 6: Bicycling Facilities

Separated bike lanes are one of many bicycle facility types that can be used to create bicycle networks, which are interconnected bicycle transportation facilities that allow bicyclists to safely and conveniently get where they want to go. Well-planned and designed separated bike lanes can complement or connect to other facilities such as on-street bike lanes and shared use paths. Separated bike lanes can appeal to a broad range of people and in doing so contribute to increases in bicycling volumes and rates. A June 2014 National Institute for Transportation and Communities report entitled "Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S." observed that ridership on all facilities increased after the installation of separated facilities. Survey data showed that 10% of current riders switched from other modes and that over a quarter of riders are bicycling more in general because of the separated bike lanes (TREC, 2014). This report is available at: http://trec.pdx.edu/research/project/583

As part of a connected bicycle network, separated bike lanes can:

- Provide a more comfortable experience for less-skilled riders;
- Improve access to destinations such as schools, jobs, health care facilities, and essential services;
- Enhance access to public transportation, for example by helping to solve the first/last mile challenge;
- Improve access to employment opportunities, especially for those without access to a private automobile; and
- Provide a linkage between regional trail systems.

Increasing active transportation to and from school will increase public health in Hawai'i and lead to outcomes like reduced childhood obesity rates.

The design of streets that are comfortable, safe and, inviting for cyclists must include the use of physical protection. In order to encourage users of all ages, there are several specific elements that should be considered. This section of this Design Manual provides criteria for selecting and implementing bike facilities. Building bicycle infrastructure that meets the needs of the most vulnerable is essential for improving options for people. The consideration of traffic safety is at the forefront of the issue, but the directness and comfort of the facilities are also important. This All Ages & Abilities facility selection guidance (presented by NACTO) is designed to be used in a wide variety of urban street types. It considers contextual factors such as vehicular speeds and volumes, operational uses, and observed sources of bicycling stress. In using this, it will help determine when, where, and how to best combine traffic calming tools with roadway design changes to increase cycling rates and rider comfort.

- In 1969, 48 percent of children 5 to 14 years of age usually walked or bicycled to school (The National Center for Safe Routes to School, 2011).
- In 2009, 13 percent of children 5 to 14 years of age usually walked or bicycled to school (National Center, 2011).
- A survey of Hawaii parents indicated that the traffic speed along the route was the second biggest impediment to allowing kids walk or bike to school (Hawaii Medical Journal, 2011).
- Traffic-related danger was also the second most common reason cited by parents nationally for not allowing their children to walk to and from school, according to the nationwide survey (CDC, 2005).
- In 2013, 288 pedestrians and bicyclists ages 14 and under were killed, and approximately 15,000 children in this same age group were injured while walking or bicycling in the United States (National Highway Traffic Safety Administration (NHTSA, 2015).

Many parents respond by driving their child to school. Better bicycle facilities are directly correlated with increased safety for people walking and driving. Bikeways that provide comfortable, low-stress bicycling conditions can make it possible for school children to travel longer distances to school. Among adults in the US, only 6–10% of people generally feel comfortable riding in mixed traffic or painted bike lanes. However, nearly two-thirds of the adult population may be interested in riding more often, given better places to ride, and as many as 81% of those would ride in protected bike lanes. Bikeways that eliminate stress will attract traditionally underrepresented bicyclists, including women, children, and seniors.

High-quality bikeways expand opportunities to encourage safe riding. Poor or inadequate infrastructure—which has disproportionately impacted low-income communities and communities of color—forces people bicycling to choose between feeling safe and following the rules of the road, and induces wrong-way and sidewalk riding. Where street design provides safe places to ride and manages motor vehicle driver behavior, unsafe bicycling decline, making ordinary riding safe and legal and reaching more riders.

High-quality bikeways expand opportunities to encourage safe riding

Choosing a Facility based on Context

The choice of an appropriate bicycle facility is based on roadway context and the target user. The consideration of protected bicycle lanes is especially important around schools and major employment centers. The following chart provides guidance in choosing a bikeway design that can create an “All Ages & Abilities” bikeway based on a street's characteristics such as motor vehicle speed and volume. The use of this chart should be considered where high quality bicycle facility is desired. Use of this guidance should recognize that a bicycle facility may fall short of the All Ages & Abilities criteria but still substantively reduce traffic stress.

Table 6-1: Contextual Guidance for Selecting All Ages & Ability Bikeways

Target Motor Vehicle Speed	Target Max Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations	All Ages & Abilities Facility
Any		Any	Any of the following: high curbside activity, frequent buses, motor vehicle congestion, turning conflicts	
<20 mph	<2,000	No centerline, or one-way	<50 motor vehicles per hour in peak direction	Bicycle Boulevard
25 mph	<1,500			
25 mph	<3,000	Single lane each way or one way,	Low curbside activity	Bicycle Lane
	<6,000			Bicycle Lane w/ optional buffer
	<15,000	Multiple lanes per direction		Buffered Bike Lane or Protected Bike Lane
	Any			Protected Bike Lane desirable
30 mph	<2,000	Single Lane		Bicycle Lane or Reduce Speed
	<9,000			Bicycle Lane w/ optional buffer
	>9,000			Buffered or Protected Bike Lane
35 mph	<9,000	Single Lane		Buffered or Protected Bike Lane
	>9,000	Any		Protected Bike Lane or Bike Path
>35 mph, High speed limited access roadways, natural corridors or other			High pedestrian volume	Bike Path or Protected Bike Lane
			Low pedestrian volume	Bike Path or Protected Bike Lane

Using Width in the Maui Design Guide for Separated Bike Lanes

The widths provided in the various cross sections in Chapter 3 provide limited opportunities to create separated bike lanes. The use of separated bike lanes are worth considering for situations where traffic stress is an issue to the local population. The following recommendations are provided by Federal Highway Administration in the Separated Bike Lane Design Guide.

One-way separated bike lanes should have a minimum width of 5 ft. Wider separated bike lanes provide additional comfort and space for bicyclists and should be considered where a high volume of bicyclists is expected. Widths of 7 ft and greater are preferred as they allow for passing or side-by-side riding. Additional care should be taken with wider lanes such that the separated bike lane is not mistaken for an additional motor vehicle lane. Total clear width between the curb face and vertical element should be at least the fleet maintenance vehicle width. Widths (inclusive of the gutter pan and to the vertical buffer element) narrower than 7 ft will often require specialized equipment. A minimum 3 ft buffer should be used adjacent to parking.

Chapter 7: Landscaping

All landscaping within roadway right-of-ways should be in conformance with the latest edition of the Maui County Planting Plan.

Street trees when properly selected and planted, have many beneficial effects including:
- Providing shade to roads and roadside parked vehicles;
- Shading and cooling sidewalk areas which increases the consideration of walking as a transportation mode and for pleasure; and
- Calming vehicular traffic speeds;

When incorporating street trees into roadway design, the designs shall:
- Consider the space needed for each selected species and ensure that adequate space and/or right-of-way is provided;
- Consider line of sight incorporating the mature size and height of the trees;
- Take into account placement with respect to traffic control devices such as signs and traffic signals;
- Maintain the clearances per Table 7-1, however the Department of Public Works reserves the right to increase the clearances on a case by case basis;
- Not allow for the placement of trees above sewer, water, or other utility lateral;

Table 7-1: Street tree clearances to features

Distance (feet)	Right-of-way feature
5	Storm drain facility
10	Crosswalk
10	Fire hydrant
10	Driveway
15	Utility pole
20	Overhead street light
20	Traffic signs
30	Roadway intersection (controlled approach)
30	End of median
100	Traffic signal faces

Table 7-2: Average Street Tree Spacing

Street Section	Description	Average Street Tree Spacing
Parkway	Parkways with sidewalks, bike lanes, and no parking	50-100 feet
Major Collector	Major Connector with bike lanes and sidewalks	40-70 feet
Minor Collector	All Minor Collectors	40-70 feet
Minor Street	All Minor Streets depending on block spacing	40-70 feet
Main Street	Residential Street with curb, gutter and sidewalk	40-70 feet

Chapter 8: Community Involvement in the Design Process

The purpose of community involvement is to have timely and meaningful dialog with community members about a proposed project. This may include education regarding established County goals, policies and standards, as well as input about goals and design concepts at key points during the process. The extent of the community involvement effort will vary depending on the complexity and significance of the project. Projects involving new roadways and/or reconfiguration of existing roadways shall have a community involvement plan. The community involvement plan will identify the type, extent, and schedule of community involvement to be incorporated into the project.

The community involvement plan should be based on one of the following levels of desired engagement:

- Inform: Community members are informed about the project but aren't actively involved in the process.
- Consult: The public is asked to provide feedback on analyses, alternatives, and decisions.
- Involve: Feedback loops allow community members to influence multiple stages or drafts of the project.
- Collaborate: The public is a partner in each phase of the decision-making process and provides direct advice on solutions.

Community Involvement Toolbox

A variety of outreach methods and tools can be used to achieve the community outreach plan, from traditional community meetings to online engagement. A variety of methods is desirable to achieve diverse community representation, including all ages and income levels. Different types of engagement may occur at different times in the process, and may include the following:

- Community meetings, workshops, and open houses.
- Focus groups (a select group of individuals that represents a distinct interest group).
- Development of a stakeholder group or advisory committee.
- Design charrettes – Community design workshops that typically start with a "blank slate" and end with a concept design.
- Attendance at established meetings held by other organizations (PTSA's, schools, church groups, neighborhood associations, business groups, clubs, etc.)
- Press releases, mailings, flyers, advertisements.
- Use of social media, websites, and crowdsourcing.
- Telephone and online surveys.
- Commission and Council meetings and public hearings.

Partnering with Other Agencies and Organizations

In some cases, community outreach can be more successful when other agencies or organizations help get the word out and/or host meetings and events. This approach should also be considered as a part of the community involvement plan.