

TIVERTON COMMERCIAL FORM-BASED CODE

Proposed Zoning with
Design Standards and Guidelines

OCTOBER 23, 2013
REVISED APRIL 2, 2014

TIVERTON, RI



Aerial Image, Bing.com

This project was supported by the Rhode Island Statewide Planning
Program with funding provided by the United States Department of
Transportation, Federal Highway Administration,

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INTRODUCTION

This is a collection of documents prepared for the proposed implementation of a form-based zoning regulation as a replacement for the General Commercial districts along Main Road north of Route 24 and in Bliss Four Corners.

The sections include:

- Zoning Districts as proposed amendments to the official map. These districts revise the current boundaries of the existing General Commercial zoning district
- Zoning Regulations including a revised table of uses and dimensional and site standards with diagrams as proposed amendments to the Tiverton Zoning Regulations
- Design Guidelines proposed to be adopted and administered in the project design and permit reviews
- The proposed Rights of Way Design Guidelines include improvements recommended for implementation by the State and through town and private investment
- Supplemental information to encourage better commercial and mixed use project design.

The documents are to be considered in combination as an approach to creating better commercial centers and individual projects in Tiverton. To implement this form-based approach, the regulations must be included as amendments to the town land use codes. The design guidelines are integral to the approach and could be adopted as part of the regulatory review process. The right-of-way improvements are capital improvements that should be promoted to the State for implementation and also considered for all development projects in the district, proportional to the size and impacts of each project.

This form-based zoning regulation is presented as a 'hybrid' in that it is adjusted to allow and encourage quality, mixed-use projects within the existing framework of local zoning codes and official maps, and within the State's process for transportation infrastructure investments. The elements may be linked as a coordinated approach through local administration and promotion of projects that could take advantage of the opportunities provided in these regulations and guidelines.

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ARTICLE IV, SECTION 19: MAIN ROAD AND BLISS FOUR CORNERS COMMERCIAL ZONING DISTRICTS

Purpose

The purpose of these zoning districts is to clarify the character of commercial development within the Main Road and Bliss Four Corners commercial zoning districts through improved design, performance and dimensional standards. These zoning districts are imposed over the existing commercial properties on the Main Road corridor and at Bliss Four Corners.

The purposes of this section are:

- to create distinctive and attractive commercial districts through a focus on the character and physical design that create unique experiences and improve the value of commercial development;
- to encourage active and viable businesses in locations that attract customers and tourists;
- to assist businesses and developments in improving properties with a consistent and clear set of standards applied in a manageable entitlement process.

Main Road



Bliss Four Corners



Districts

Three zoning districts are proposed:

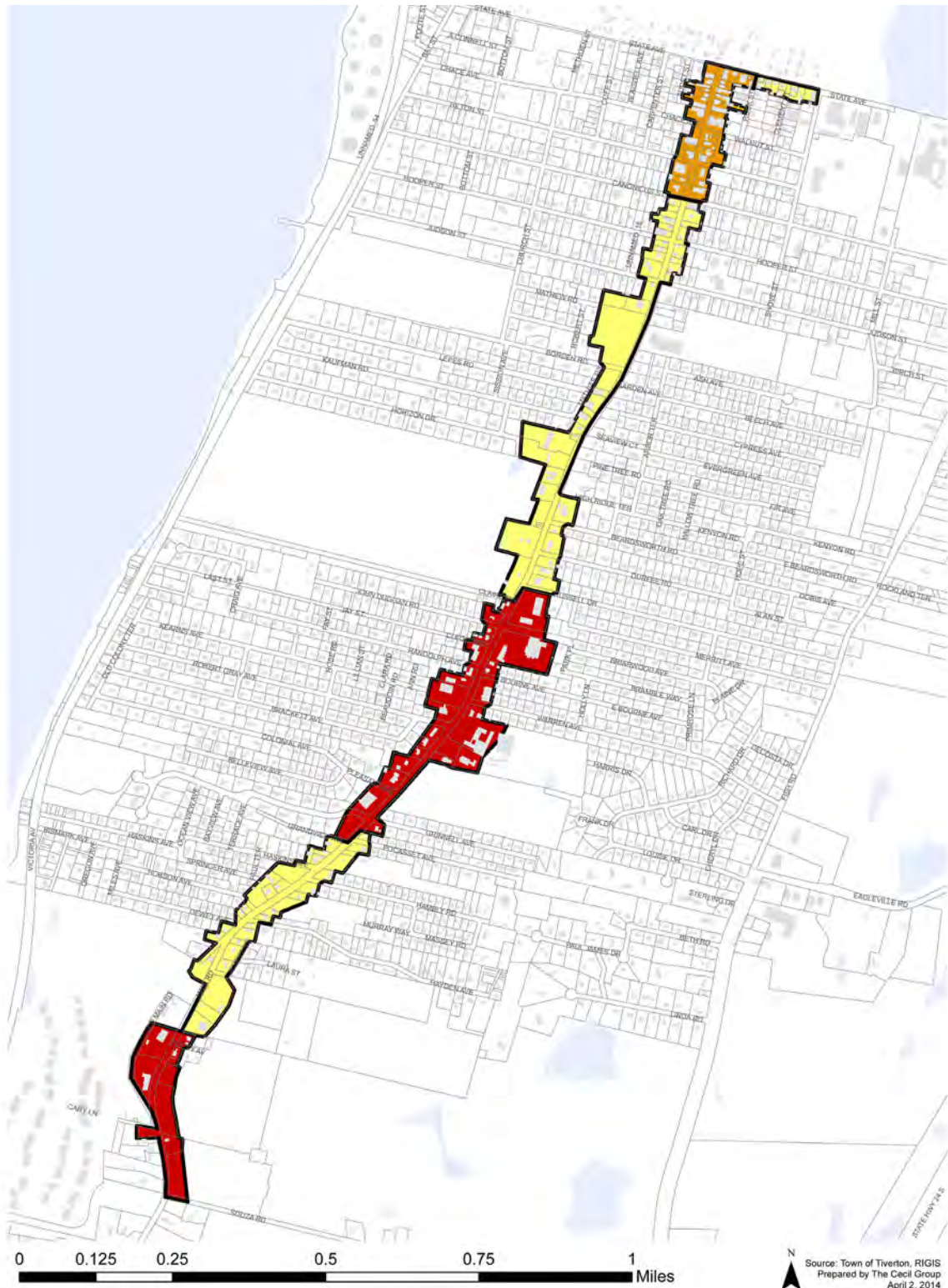
- Traditional Main Street – A configuration with zero front yard setbacks, lots of pedestrian amenities, and on-street and rear-yard parking, where the first floor is assigned for retail and restaurant uses and the upper floors may be residential and commercial office.
- Pedestrian Friendly Destination – Clusters of businesses in new destinations centers where the design of improvements within and adjacent to the property creates a comfortable and safe pedestrian environment.
- Neighborhood Business – Transitional areas indicated by design as low density residential sections where homes have been converted to small-scale commercial and mixed uses.

Applicability

The zoning districts apply as identified for all uses listed in Article IV. District Use Regulations; Zoning District Use Table.

Zoning Maps

Main Road



Main Road: New Commercial Districts

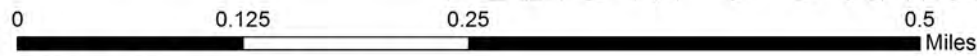
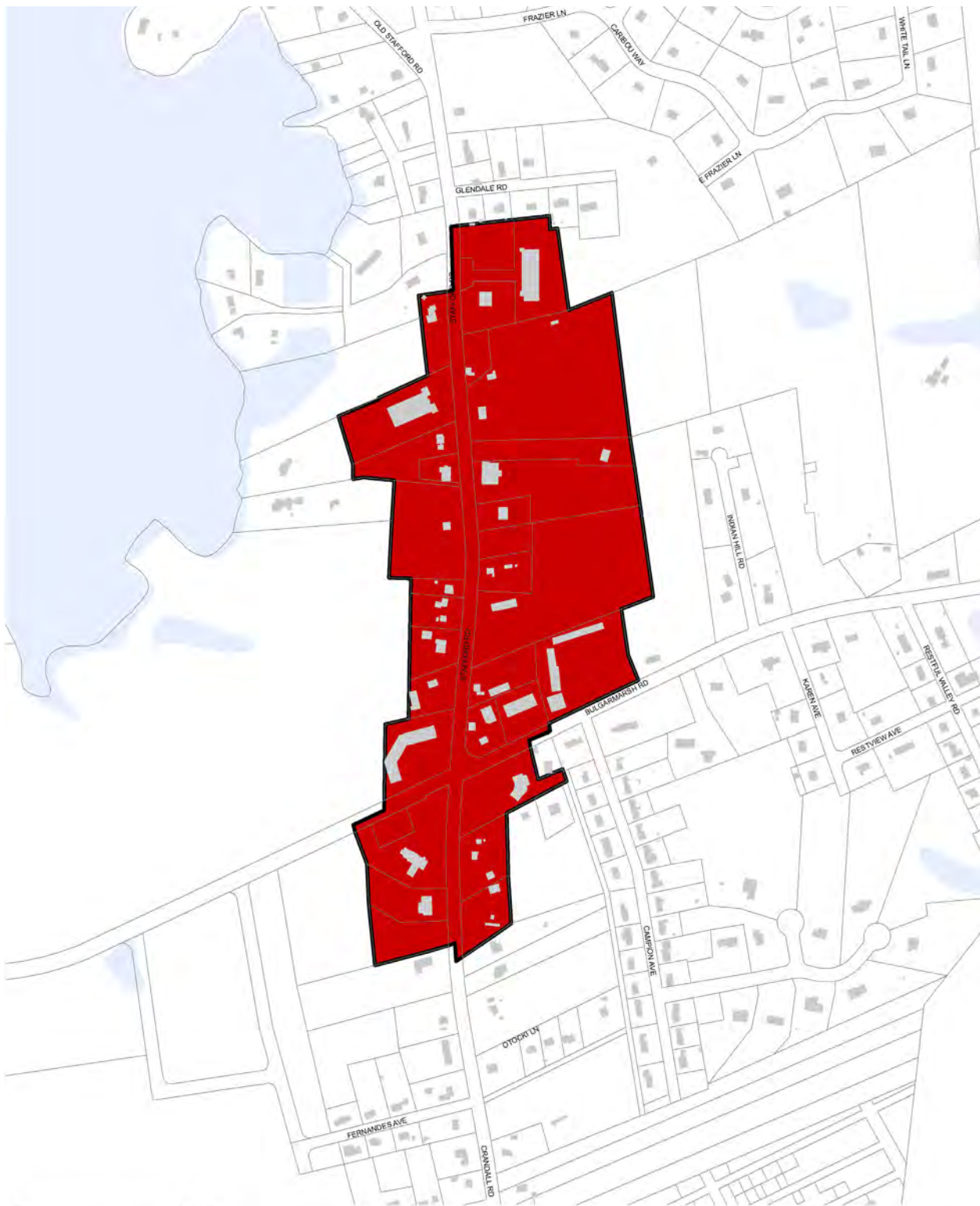
Tiverton, RI

- Traditional Main Street District
- Pedestrian Oriented Destination District
- Neighborhood Business District

Source: Town of Tiverton, RIGIS
 Prepared by The Cecil Group
 April 2, 2014

Zoning Maps

Bliss Four Corners



N
 Source: Town of Tiverton, RIGIS
 Prepared by The Cecil Group
 April 2, 2014

Bliss Four Corners: New Commercial District

Tiverton, RI

 Pedestrian Oriented Destination District

ZONING

Uses

Proposed Revisions to Article IV. District Use Regulations; Zoning District Use Table

P = The use is permitted, [but subject to administrative review](#)

P*= The use is permitted according to note

S = The use is permitted only as a special use granted by the zoning board of review, in accordance with articles XV and XVI.

N = The use is not permitted

Use	Existing GC District	Proposed Overlay District		
		TMS	PFD	NB
Section 2. - Residential uses				
a. Single-family dwelling	N	N	N	P
b. Two-family dwelling	N	N	N	P
c. Multi-family structure or apartment house* <i>* The first floor on the building frontage in the TMS district may only be used for commercial retail and retail uses</i>	N	P*	P	P
d. Mixed-use residential* <i>* The first floor on the building frontage in the TMS district may only be used for commercial and retail uses</i>	P	P*	P	P
e. Household	P			
ef. Community residence	P	N	N	P
fg. Family day care* <i>* "Group family day care home" according to state regulations for licensure</i>	P	N	NP	P
gh. Taking of boarders or the renting of rooms by a resident family (not to exceed two roomers or boarders)	S	S	S	S
hi. Bed and breakfast	S	N	S	P
ij. Motel or hotel	P	S	P	S
jk. Home occupation carried on by the occupant of the residence, including residential arts and crafts but excluding sales of such items* <i>* Exception: sales are permitted in the NB district</i>	P	P	P	P*
kl. Sale of agricultural products grown on the premises	P	P	P	P
lm. One satellite receiving antenna, one meter or less in diameter	P	P	P	P
ma. Satellite receiving antenna, more than one meter and up to two meters in diameter	P	P	P	P
ne. Satellite receiving antenna, more than two meters in diameter, or more than one antenna of any size	S	S	S	N
op. Convalescent, rest or nursing home	S	S	S	S
pq. Retirement residence/assisted living facility/and continuing care facility	S	N	S	S
qr. Manufactured home elderly community	N	N	N	N
rs. Accessory building including a garage, shed, studio and any other building incidental to and located on the same lot as the residential use permitted	N	S	S	SP

ZONING

Use	Existing GC District	Proposed Overlay District		
		TMS	PFD	NB
Section 3. - Farming or raising of animals				
a. Commercial raising of crops, including associated greenhouse or nursery*	P	N	P	P
b. Commercial raising of animals or fowl. This includes kennels for the raising, boarding or sale of dogs, cats or other fur-bearing animals, but not the raising of swine. <u>Retail pet sales and supplies that do not include the raising of animals are regulated separately as a retail use and not as a farming use.</u>	S	N	N	S
c. Preserve for the protection of wildlife and plant life	P	P	P	P
d. An accessory building or structure to be used for the display and sale of the agricultural products produced by the uses allowed herein on said land	P	N	P	P
e. Accessory building including a garage, greenhouse, stable, barn, pen, coop, kennel, crib, silo and any other building, equipment or activity incidental to, necessary for and located on the same lot as the agricultural use permitted***	P	N	S	S
f. Aquaculture	N	N	S	S
Section 4. - Public and semipublic uses				
a. Church or other place of worship	P	P	P	P
b. Nonprofit organization club, lodge, social or community center building* <i>___*Must not be located on the first floor on the building frontage in the TMS district</i>	P	P*	P	P
c. Art center	P	P	P	P
d. Membership athletic club* <i>— *Must not be located on the first floor on the building frontage in the TMS district</i>	P	S*	P	N
e. Hospital, medical center or clinic	S	S	S	S
f. Municipal or government building	P	P	P	P
g. Fire or police station	P	P	P	P
h. Day care center – ‘Child day care center’ licensed by the state under R.I.G.L. Chapter 72.1 – Licensing and Monitoring of Child Care Providers, and Adult Day Care Programs licensed under R.I.G.L. section 23-1-52	S	S	P	P
i. Private non-profit school* <i>— *Regulated under R.I.G.L. Title 16, Chapter 40, and above the first floor in the TMS subdistrict</i>	S	P*	S	P
j. Junior college, college or university* <i>— *Regulated under R.I.G.L. Title 16, Chapter 40, and above the first floor in the TMS subdistrict</i>	S	P*	S	N
k. Private trade, professional or other school* <i>— *Regulated under R.I.G.L. Title 16, Chapter 40, and must be located above the first floor in the TMS subdistrict</i>	P	P*	P	S
l. School conducted as a private gainful business for teaching subjects such as music, singing, and dancing, karate or martial arts, and computer training	P	P	P	P
m. Cemetery, whether public or private*	S	S	S	S

Use	Existing GC District	Proposed Overlay District		
		TMS	PFD	NB
Section 5. - Public utility uses				
a. Electric power generating station	N	N	N	N
b. Electric power substation	S	N	S	S
c. High voltage electric transmission towers	S	N	S	S
d. Towers, including but not limited to, radio frequency towers	S	S	S	S
e. Water tower	S	S	S	S
f. Sewage treatment plant or solid waste disposal facility* – <i>*Except a wastewater treatment facility servicing the development</i>	S	N*	N*	N*
g. Municipal water and sewer lines	P	P	P	P
h. Public utility structure not otherwise specified	S	S	S	S
Section 6. - Open recreation uses				
a. Golf course or golf club	N	N	N	N
b. Driving tee or range, miniature golf course, or similar use operated for commercial purposes	S	N	S	N
c. Public park				
(1) To include structures for shelter, education and comfort of users	P	P	P	P
(2) To include furnishing of food and drink, and personal services and equipment incidental to use of such park	P	P	P	P
d. Bathing beach	P	N	N	N
e. Municipal or commercial swimming pool	P	NS	P	S
f. Swimming pool as an accessory use	P	S	P	P
g. Riding stable or academy	N	N	N	S
h. Yacht club or marina	N	N	N	N
i. Waterfront recreation business. This includes boat rentals and tours, charter fishing boats or similar uses	N	N	N	N
j. Other open commercial recreational use	S	S	S	S
k. Campground	N	N	N	N
Section 7. - Office uses				
a. Professional home office – <i>*May be larger than 250sf but no more than the first floor of the building</i>	P	P	P	P*
b. Professional and general office including real estate, insurance etc. – <i>May not be located on first floor in TMS district</i>	P	P*	P	P
c. Bank, credit union or office building				
c.-(1) Bank, credit union or office building Not including drive through service	P	P	P	P
d. -(2) Any use <i>Bank, credit union or office building</i> which includes including drive through service	S	N	S	N
e. Temporary sales or promotion office in connection with adjacent construction limited to one year	P	P	P	P

Use	Existing GC District	Proposed Overlay District		
		TMS	PFD	NB
Section 8. - Restaurants and entertainment* <i>* May be subject to other licensing requirements separate from zoning compliance.</i>				
a. Restaurant				
(1) Not including entertainment	P	P	P	P
(2) Including entertainment	S	P	P	S
b. Tavern or night club				
(1) Without adult entertainment	S	S	S	S
(2) With adult entertainment	N	N	N	N
c. Theater or concert hall	S	S	S	S
d. Indoor commercial recreation	P	S	P	S
e. Restaurant with drive- through service	S	N	S	N
Section 9. - Service business				
a. Personal convenience services, including but not limited to: barber shop, beautician, shoe repair, tailor	P	P	P	P
b. Laundromat or dry cleaning facility	P	S	P	S
c. Specialty services, including but not limited to: printing shop, photo studio, interior decorating shop, catering service	P	P	P	P
d. Mortuary or funeral home, crematorium	P	S	S	P
e. Electronic or appliance repair shop	P	P	P	P
f. Veterinary office or animal hospital	P	N	P	S
g. General automotive repair shop	S	N	S	S
h. Vehicle rental agency	S	N	S	S
i. Self-service car wash	S	N	S	N
j. Commercial dock or pier	N	N	N	N
k. Storage, repair and sales of boats and marine accessories* - <i>*Sales of boats and marine accessories is permitted if there is no storage or repairs of boats.</i>	S	P*	P*	P*
Section 10. - Retail business				
a. Retail business <u>of ≤ / = 1015,000 square feet Gross Leasable Area</u> General retail business, including but not limited to: grocery/convenience store, pharmacy, hardware store, variety/general merchandise store, furniture/house-hold goods store	P	P	P	P
b. Retail business <u>or complex between >1015,000 square feet and ≤ / = 40,000 square feet Gross Leasable Area</u> Specialty retail business, including but not limited to: antique store, bookstore, decorative arts/house- wares/furnishings store, specialty food store	P	N S	S	N
c. Retail center [shopping centers, malls, mini-malls and strip-malls] <u>>40,000 square feet Gross Leasable Area</u>		N	S	N
d. Any retail business <u>including-with</u> drive through service. <u>Single or multiple structure shopping centers, malls, mini-malls and strip-malls.</u>	S	N	S	N
e. Retail business, office and/or consumer service complex	S			

Use	Existing GC District	Proposed Overlay District		
		TMS	PFD	NB
e. Retail sales accessory to the manufacture or assembly of products on the premises	P	P	P	P
f. Retail sales with open lot storage	S	N	S	N
g. Retail sales of agricultural products, the majority of which are not grown on the premises <u>and are <= 5,000 square feet</u>	P	P	P	P
h. Package liquor store	P	P	P	S
i. Adult book/video store	N	N	N	N
j. Gasoline filling station, including retail sales as an accessory use	S	N	S	N
k. Auto or truck sales in a building (including repairs) or an open lot	S	N	S	N
l. Trailer sales, service and storage	S	N	S	N
Section 11. - Transportation uses				
a. Commercial airport or heliport	N	N	N	N
b. Private landing strip or helipad	S	N	N	N
c. Bus or rail passenger station	S	S	P	<u>SN</u>
d. Commercial off-street parking facility, including bus or other vehicle storage	S	S	S	N
Section 12. - Wholesale business and storage.				
a. Wholesale business and storage of nonflammable and non-explosive material in a building	S	N	S	N
b. Wholesale business which may include open lot storage of material, products and/or construction or other equipment	N	N	N	N
c. Mini-storage facility	S	N	N	S
d. Storage of flammable and/or explosive material	S	N	N	S
e. Retail outlet accessory to a wholesale or storage use	S	N	S	N
Section 13. - Industrial uses.				
a. Manufacturing, storing, processing, fabricating, activities in conformance with article XIII	N	N	N	N
b. Product assembly, including but not limited to: electronic items, computers, optical goods and instruments, laboratory and scientific instruments, watches and clocks, games and toys, and advertising displays	P	S	S	S

ZONING

Section 14. – Accessory Uses

- a. An accessory use which is clearly incidental and secondary to the principal permitted use of the premises or structure shall be allowed, provided, however, that such accessory use:
 - a. shall be a use allowed within the district,
 - b. shall be located on the premises to which it is accessory, and
 - c. shall not be detrimental to or impair adjacent properties or the neighborhood.

b. Where a principal use is allowed by special use permit, an accessory use which is clearly incidental and secondary to the principal use shall be allowed by special use permit, provided that such accessory use shall be located on the premises to which it applies, and shall not be detrimental to or impair adjacent properties or the neighborhood.

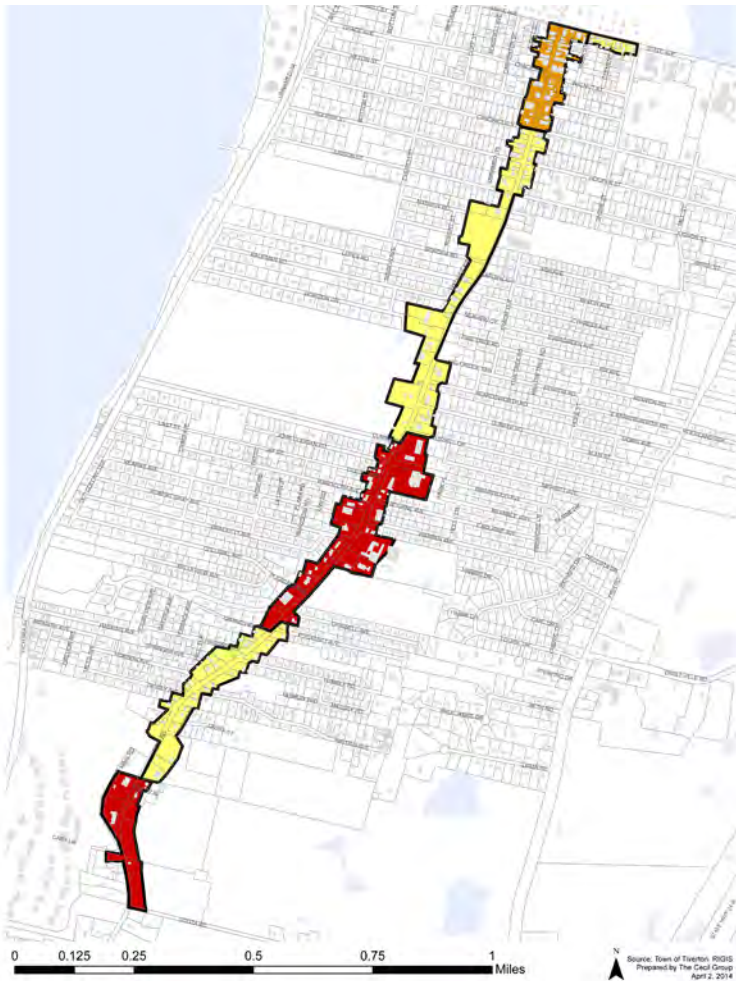
c. The following standards shall apply to the determination of detrimentality or impairment under this section:

a. The accessory structure or use extends or creates a dimensional nonconformity, impairs views or vistas or does not reasonably conform to the average dimensions found in the neighborhood.

b. Allowed are normal repairs or alterations to a conforming accessory structure, and alterations to comply with requirements of the Rhode Island Building Code.

PART II - LOT DIAGRAMS

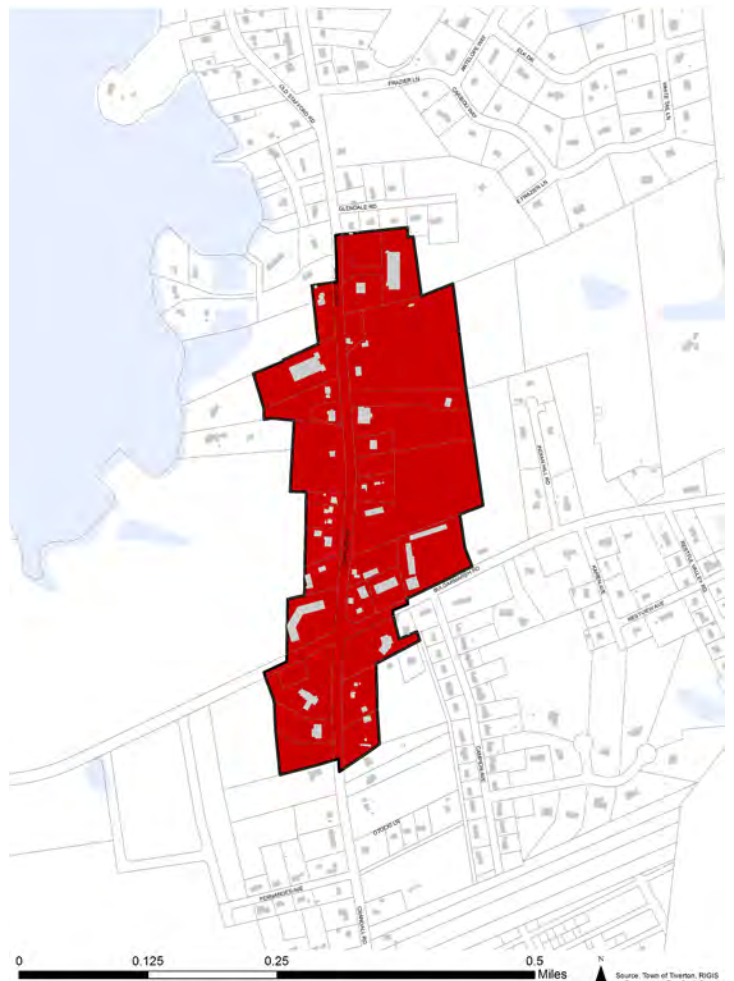
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Main Road: New Commercial Districts

Tiverton, RI

- Traditional Main Street District
- Pedestrian Oriented Destination District
- Neighborhood Business District



Bliss Four Corners: New Commercial District

Tiverton, RI

- Pedestrian Oriented Destination District

GC
GENERAL COMMERCIAL
(EXISTING)

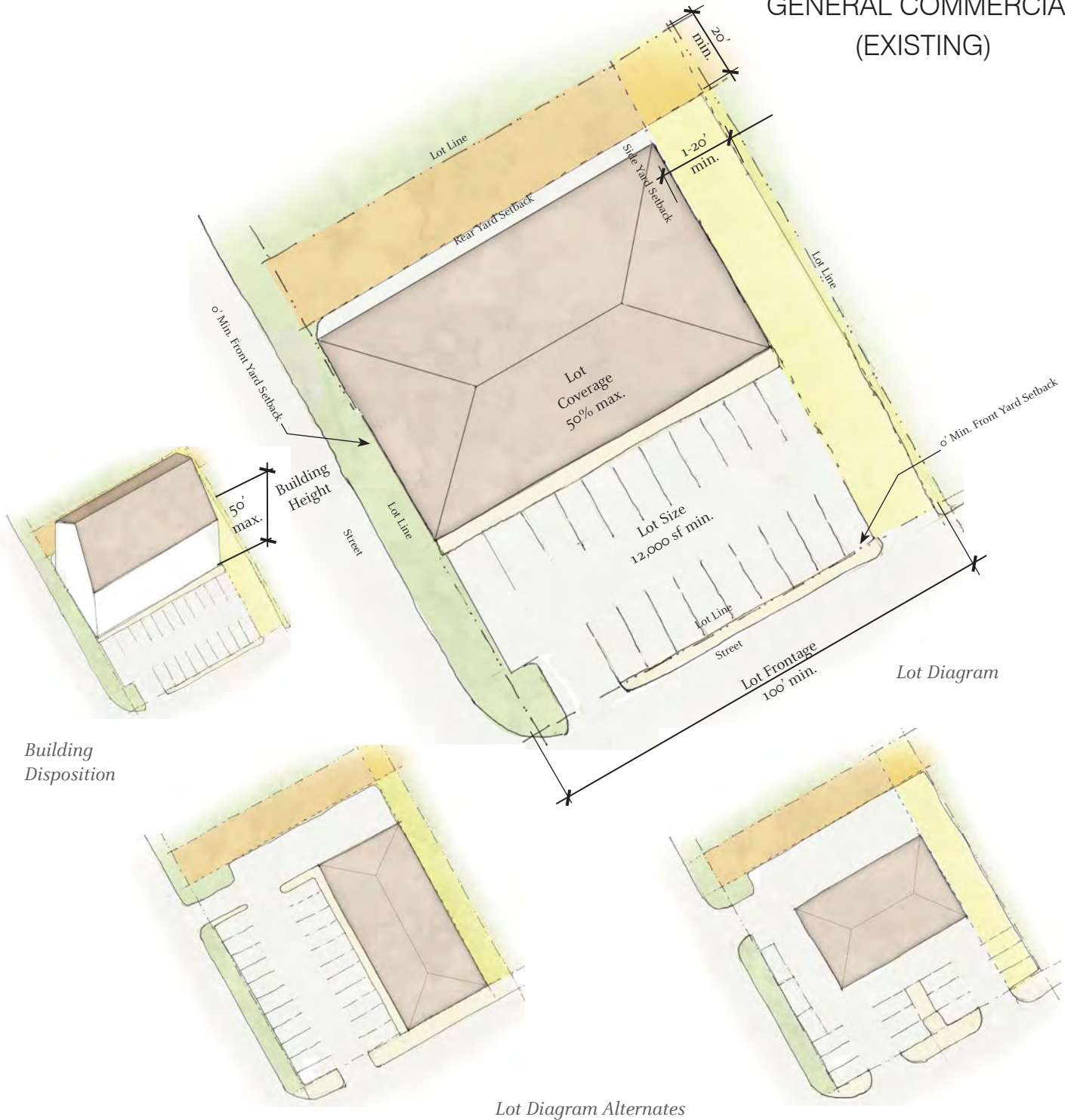
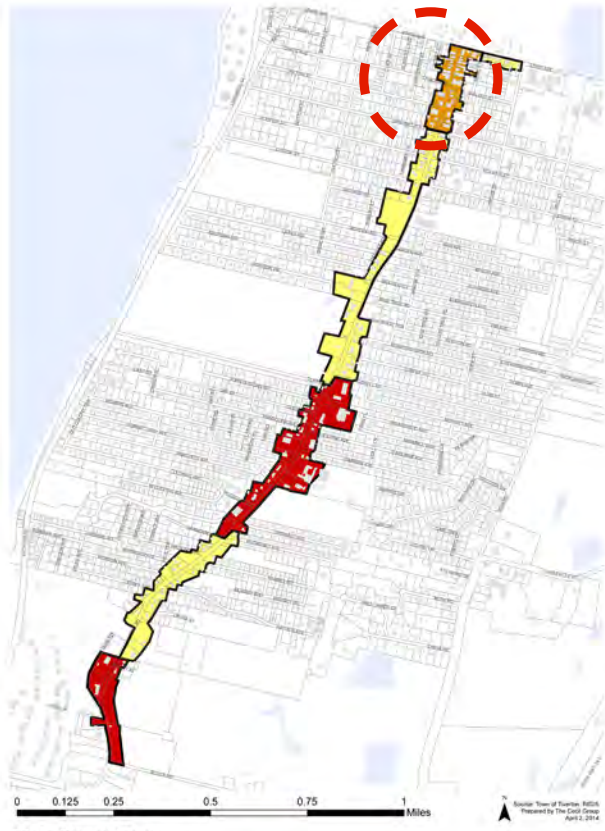


Table of Dimensional Regulations	Minimums					Maximums		* Additional Regulations Reference
	Lot Size* (sf)	Lot Width* (ft)	Front Yard Setback* (ft)	Side Yard Setback* (ft)	Rear Yard Setback* (ft)	Lot Coverage (%)	Building Height*	Article V
GC General Commercial*	12,000	100	0	1-20	20	50	50	



Main Road: New Commercial Districts
Tiverton, RI

- Traditional Main Street District
- Pedestrian Oriented Destination District
- Neighborhood Business District

TMS

Traditional Main Street (Proposed District)



Tiverton North Main St. Precedent



Traditional Main Street Examples



LOT DIAGRAMS

TMS

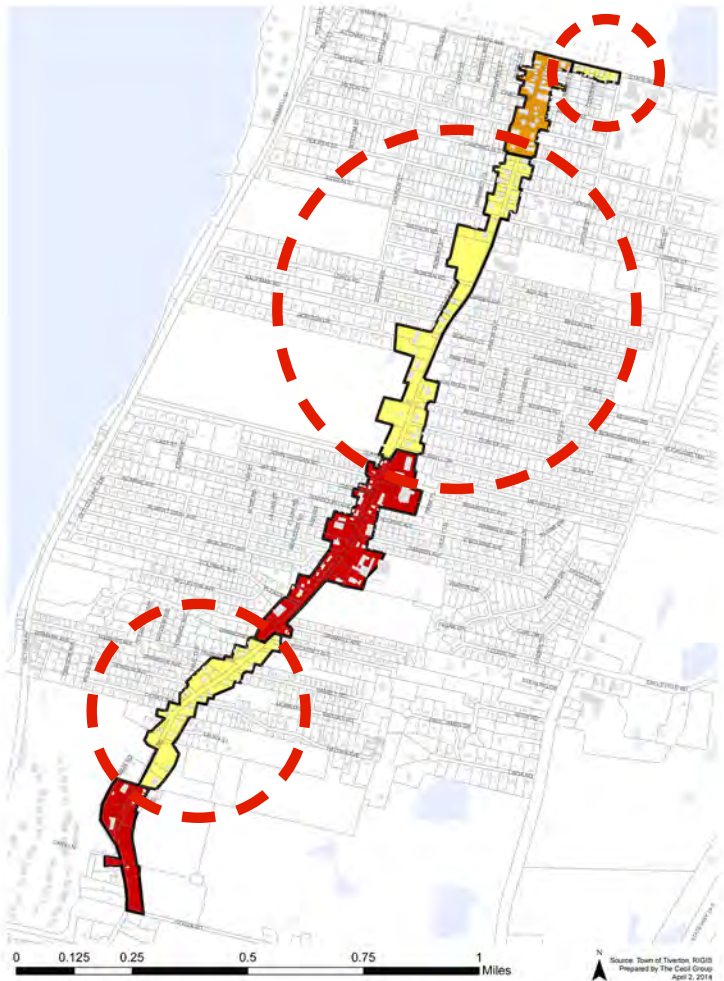
Traditional Main Street (Proposed District)



Table of Dimensional Regulations	Minimums					Maximums		* Additional Regulations Reference
	Lot Size* (sf)	Lot Width* (ft)	Front Yard Setback* (ft)	Side Yard Setback* (ft)	Rear Yard Setback* (ft)	Lot Coverage (%)	Building Height*	Article V
General Commercial*	12,000	100	0	1-20	20	50	50	
TMS Traditional Main Street Proposed*	10,000	40	0-10 max.	0	35	80	50	

NB

Neighborhood Business (Proposed District)



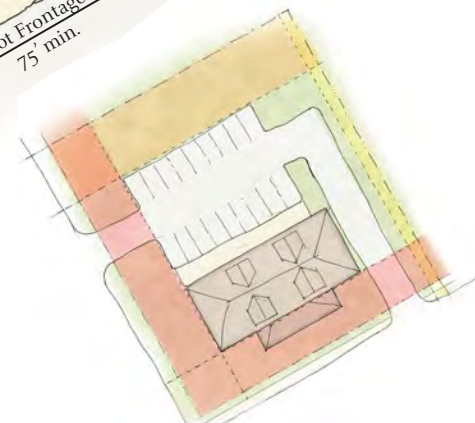
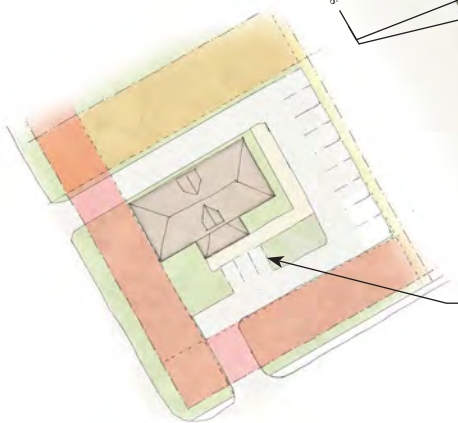
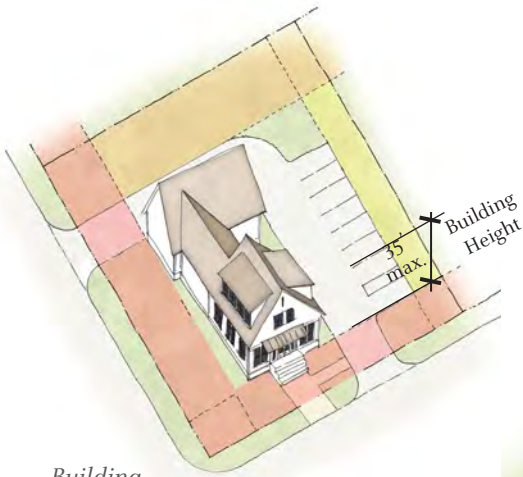
**Main Road: New
Commercial Districts**

Tiverton, RI

- Traditional Main Street District
- Pedestrian Oriented Destination District
- Neighborhood Business District

NB

Neighborhood Business
(Proposed District)



Lot Diagram Alternates

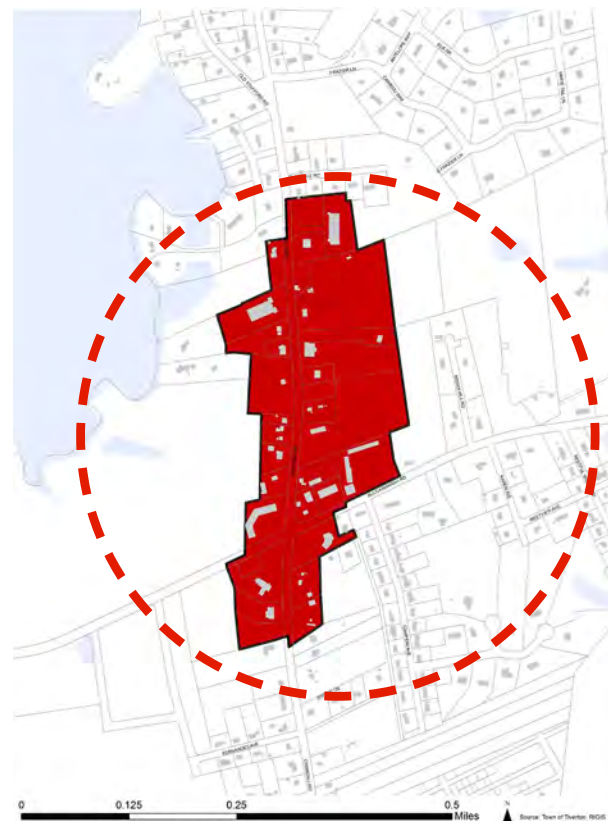
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	Lot Size* (sf)	Lot Width* (ft)	Front Yard Setback* (ft)	Side Yard Setback* (ft)	Rear Yard Setback* (ft)	Lot Coverage (%)	Building Height *	Article V
General Commercial*	12,000	100	0	1-20	20	50	50	
NB Neighborhood Business Proposed*	15,000	75	25	5	35	25	35	

*Max. 25% of Req. Parking Located in Front Yard



Main Road: New Commercial Districts
Tiverton, RI

- Traditional Main Street District
- Pedestrian Oriented Destination District
- Neighborhood Business District



Bliss Four Corners: New Commercial District

Tiverton, RI

- Pedestrian Oriented Destination District

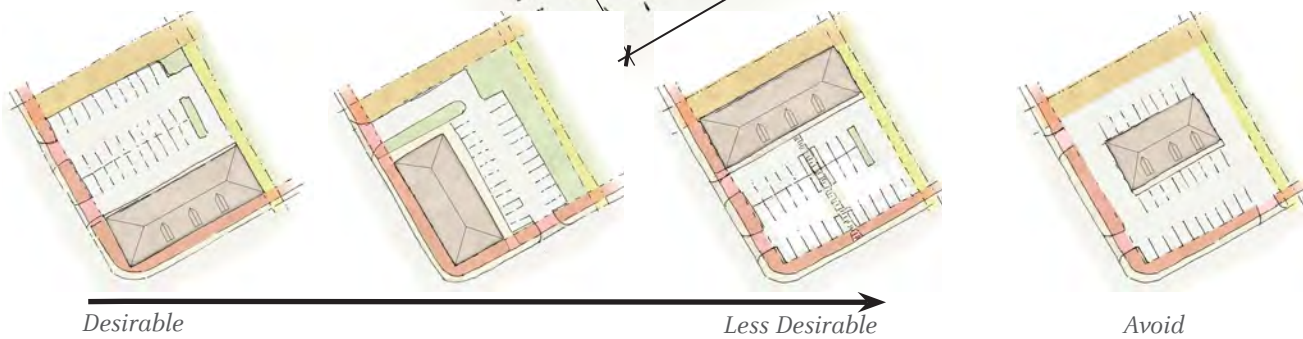
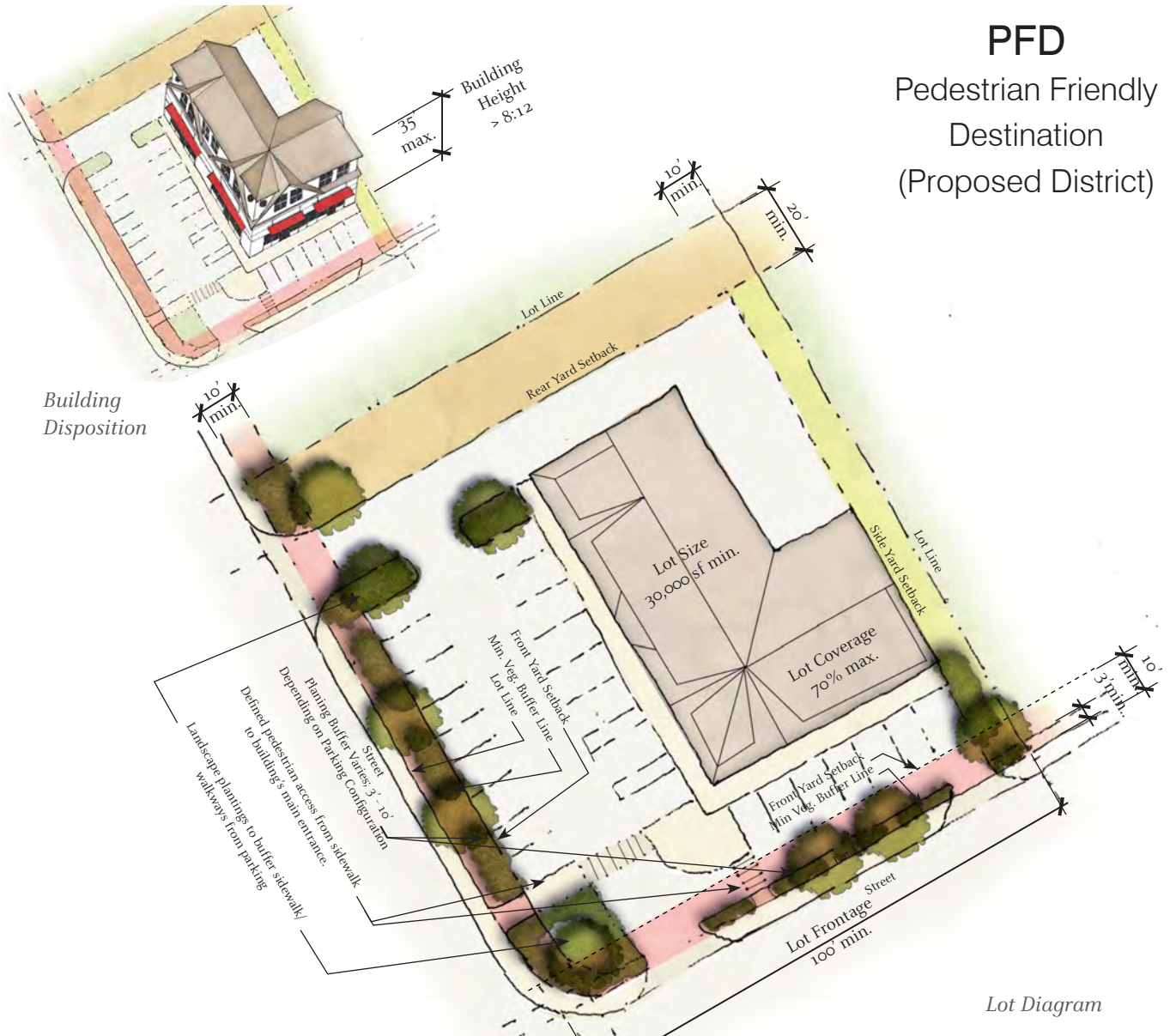
PFD

Pedestrian Friendly Destination
(Proposed District)



PFD

Pedestrian Friendly
Destination
(Proposed District)



Lot Diagram Alternates

Table of Dimensional Regulations	Minimums					Maximums		Additional Regulations Reference
	Lot Size* (sf)	Lot Width* (ft)	Front Yard Setback* (ft)	Side Yard Setback* ¹ (ft)	Rear Yard Setback* ¹ (ft)	Lot Coverage (%)	Building Height *	
General Commercial*	12,000	100	0	1-20	20	50	50	*Article V ¹ When adjacent to another commercial property, setback can be zero to allow party walls; when adjacent to residential, the setback minimums are required. ² Setback required for improved pedestrian circulation on the ground level; overhanging and cantilevered upper stories are allowed to the edge of the lot line to form covered walkways. In all cases, 3' minimum planted buffer. **For buildings ≥ 20,000 SF or parking areas 60 spaces, 50% coverage. All other projects, 70%.
PFD Pedestrian Friendly District Proposed*	12,000	100	10 ²	10	20	50/70**	≥8:12=35' <8:12=25'	

PART III - DESIGN GUIDELINES

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DESIGN GUIDELINES

The Design Guidelines are a resource of information for property owners, designers, builders, developers, town officials and volunteers to use as a guide for the growth and evolution of Tiverton's commercial districts. This set of guidelines attempts to capture those characteristics of traditional commercial and mixed use architecture that exemplify the best of Tiverton's, and New England's, historic character. While much of the commercial district has been built out over the last 30 years with a palette of materials and building types that have not always been contextual, there is no reason that, over time, the patterns of development (site organization, circulation and architectural detail) cannot begin to re-introduce some of Tiverton's inherent history and charm into these commercial areas.

This by no means suggests that design must always adopt a traditional appearance. Rather, this document is organized around principles of tested precedent and offers guidance to those who are interested in enhancing the character of Tiverton. By definition, tradition in architecture includes practices and patterns that have been validated and reaffirmed over time as the most pleasing to the most people or demonstrably more functional or efficient.

To ensure the right of way improvements are coordinated with the adjacent property improvements, guidelines are also listed for vehicle, bicycle and pedestrian safety and comfort.

These Guidelines, therefore, set out to illustrate those patterns as they are observed either in Tiverton or in New England so that the designer, builder, neighbors and officials charged with permitting are better able to achieve the goal of enhancing Tiverton's commercial districts.

For additional resources on these approaches to design, please review the reference list in the appendix.



A large building can be designed to fit with the scale of Tiverton.

Building Scale & Character Traditional Main Street

Characterized by dense mixed-use development with a concentration of retail street frontage.

Tiverton's north end main street is a traditional urban retail street that should be preserved and enhanced to achieve its full potential.

Key Points

- Though a 50' height is allowed, the typical pattern here suggests 3-4 stories with a mixed-use character and a mix of roof lines.
- Strong retail frontage at the sidewalk is critical.
- A mix of materials in the district is possible - including masonry clapboard and shingle



Sloped roofs are possible, particularly above the second story.

Upper floors should have a residential character

Street frontage retail has large glazing, clear signage and lighting focused on the storefront



A variety of roof forms are appropriate in the traditional main street district including flat, gable and gambrel. Typically buildings are of two to three stories in height with the upper floors appearing to be, if not actually residential in use.

DO



Encouraged

Two to three story structures with a taller first floor retail level topped by 2 to three stories of residential. Party walls encouraged.

AVOID



Discouraged

One story retail structures are not in keeping with the New England main street prototype and should be avoided



Building Scale & Character Neighborhood Business

Residentially scaled mixed-use and live/work architecture reflects the patterns of the surrounding residential neighborhoods.

Tiverton's neighborhood business character is best characterized by homes that have been converted for retail or professional office use.

The buildings in this district should be inspired by the appearance of a single family home where the first floor has been converted to retail or office and the upper floors are either residential or office in use.

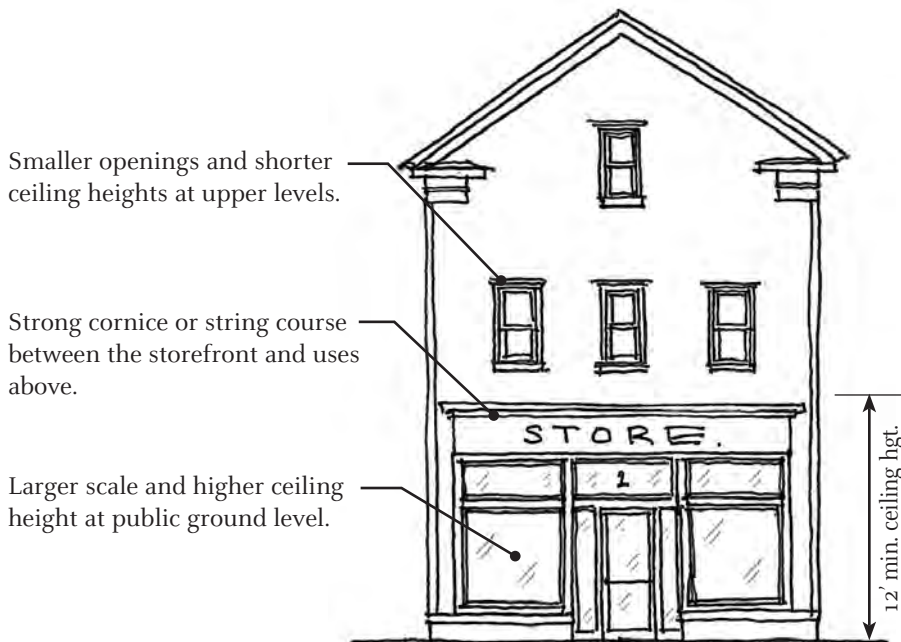


Key Points

- Residentially scaled retail / office with deeper setbacks and more casual parking
- A variety of scales, roof forms and materials.
- Typically two story architecture with a third floor possible in dormers or occupied attics

Traditional neighborhood retail was a product of a ground floor devoted to providing local goods and services while the owners lived on the level or levels above. The neighborhood business district is seeking to re-capture this pattern of use and architecture.

Characteristics of live-work / neighborhood retail architecture



Key Points:

- Ground level retail should have a minimum ceiling height of 12', 16' preferred. The taller space and larger scale of the storefront is appropriate to the retail use.
- Shorter ceiling heights and smaller scale openings are appropriate on upper stories used for office or residential.
- A strong cornice or string course separates the scale of the storefront and residential openings above.

The different scales of multiple uses can lend itself to a balanced composition.

Building Scale & Character Pedestrian Friendly Destination



Larger retail footprints can be accommodated within architecture that is more in keeping with Tiverton's historic roots.

Larger retail footprints are organized on a major thoroughfare.

Tiverton's larger retail and commercial nodes should be improved by encouraging architecture and amenity to provide stronger support for pedestrian activity.



Pitched or gambrel roof forms reflect architectural character of the community and provide additional leasable space

Pedestrian scale treatments at the retail level is encouraged.

Pedestrian access from parking (shown) and street frontage is clearly defined and landscaped to encourage walking.



Upper floors can be offices or storage where necessary to maintain mixed use scale when the market can not support residential.

Key Points

- Discourage single story flat roofed retail buildings set back behind a large parking area
- Introduce pitched roofs and the scale of mixed use architecture as a way to introduce traditional New England character into the more modern retail district
- New buildings must orient towards the sidewalks.

A complex of smaller scale buildings is preferable to a single large structure because the varied massing provides visual interest and human scale.

DO



Encouraged

Buildings with the impression of more than a single story organized behind well landscaped and pedestrian friendly parking areas

AVOID



Discouraged

Single story structures devoid of architectural treatment and set back behind a sea of parking



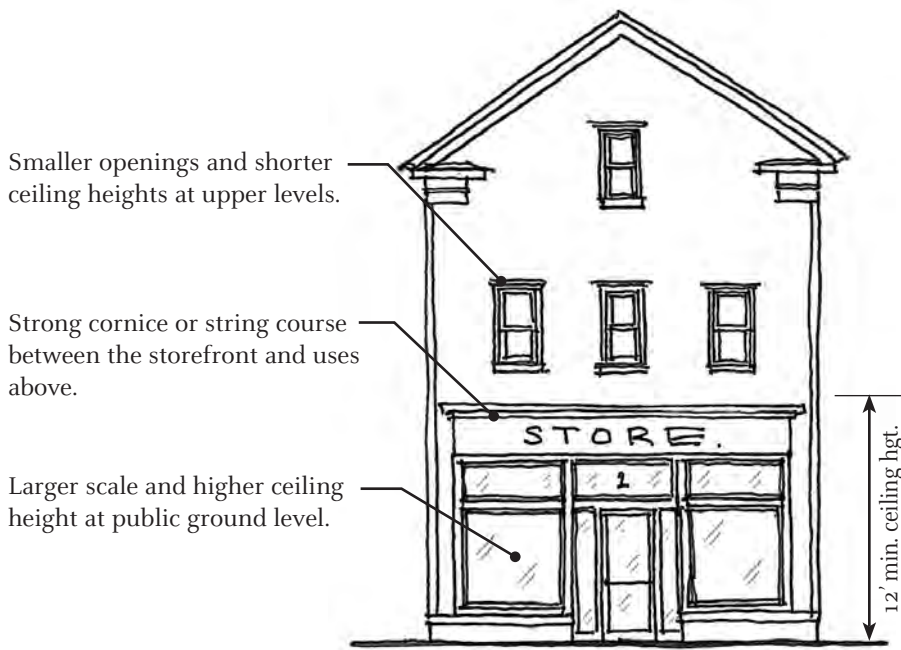
A change in scale distinguishes the change between uses.

Scales of Use

Mixed-use buildings change scale and character with uses.

Mixed-use buildings are traditionally designed with the scale and features appropriate to each use. The transition between the lower and upper floors is important to the design of the building as a whole.

DO



The different scales of multiple uses can lend itself to a balanced composition.

Key Points:

- Ground level retail should have a minimum ceiling height of 12', 16' preferred. The taller space and larger scale of the storefront is appropriate to the retail use.
- Shorter ceiling heights and smaller scale openings are appropriate on upper stories used for office or residential.
- A strong cornice or string course separates the scale of the storefront and residential openings above.

AVOID



Poorly proportioned buildings result when either of the mixed-use functions are not of the appropriate scale.

Building Location & Parking Traditional Main Street

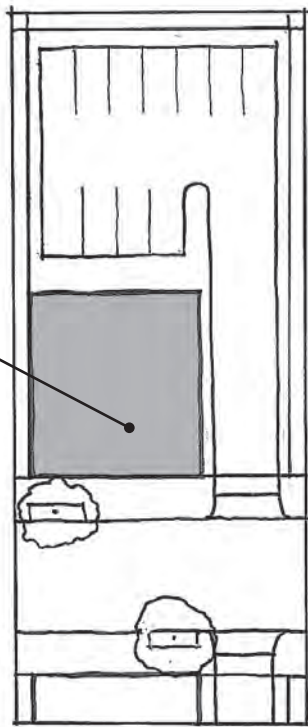


A traditional retail building meets the sidewalk to engage pedestrians in window-shopping.

Stores engage the sidewalk on a traditional retail main street.

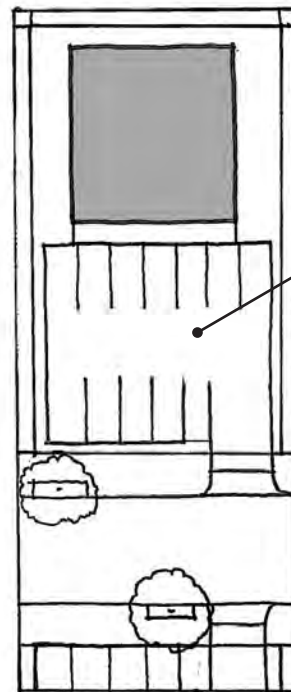
In the traditional main street district, buildings should engage the sidewalk and form a street wall that contributes to the character of the street by having little or no setback from the front property line.

DO



Storefronts shall have little or no setback encouraging window shopping and a casual retail experience with a strong pedestrian focus

AVOID



In the traditional main street district, a deep setback occupied by parking removes the retail from the pedestrian and creates unsafe conditions where parking curb cuts cross the pedestrian network.



The front of the shops form a street wall that define the street as a public room.



Mixed use and retail in the neighborhood business district are similarly affected by large parking fields in front.



Building Location & Parking Neighborhood Business

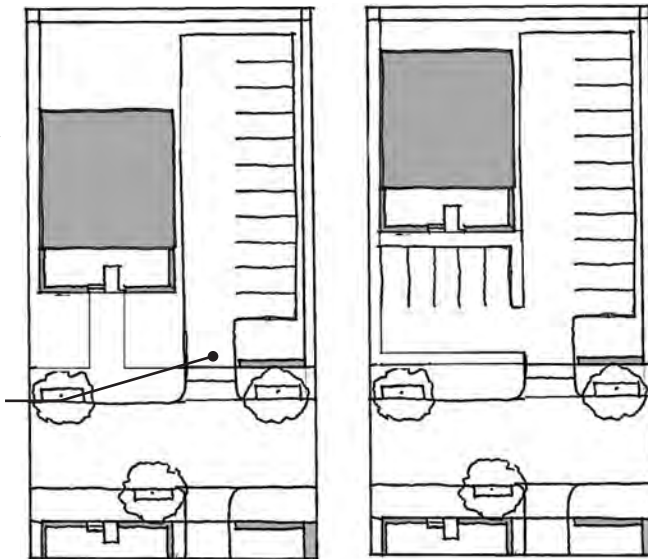
Mixed-use neighborhood, setbacks approximate to the residential context.

The residentially scaled mixed use architecture of the neighborhood business district should be set behind a modest setback that reflects the surrounding context.

The more residentially scaled “Neighborhood Business” district is characterized by buildings of a lower scale that have a deeper setback from the primary road than the traditional main street

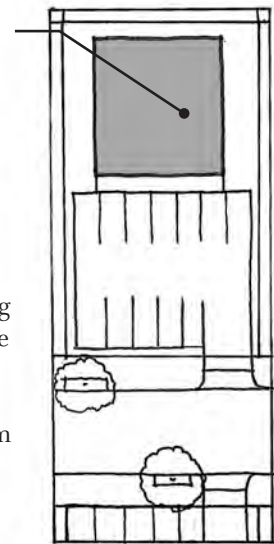
DO

Buildings in the neighborhood business district should repeat the pattern of the surrounding residential district. A reasonable setback from the road behind a layer of landscape, casual seating or informal parking is appropriate.



AVOID

Buildings in this district should not, however, be set back behind more than a single layer of casual parking. Large parking fields alienate patrons and remove the building from the residential fabric.



A single layer of casual parking and/or small buffers with landscape and amenities are idea of the neighborhood business district. The buildings, either single or mixed use, have a residential character and are arranged in ways that reflect the pattern of the surrounding residential neighborhoods.



Building Location & Parking Pedestrian Friendly Destination

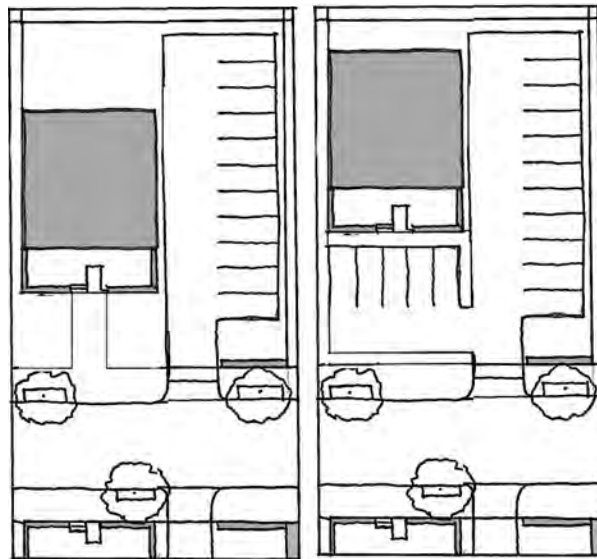
Special attention is paid to pedestrian access and to creating a street and spaces comfortable for walking.

Buildings should be placed to maximize pedestrian access. The goal is to attract pedestrians from the neighborhood and to attract cars to park and then walk around the destination to the attractions.

The Pedestrian Friendly district is a human-scale corridor despite larger retail footprints created through amenable places and pedestrian permeability. The larger footprints are visually broken at small intervals by micro attractions.

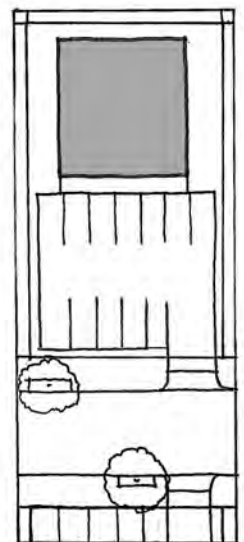
DO

The district should be easily accessible by car, but even easier to walk around. The facade sits on or close-to the site limits, with cut-outs for amenities such as benches, terraces, and vegetation. The buildings should be accessible by both the front street-side facade and the rear parking facade.



AVOID

Avoid parking areas that provide no clear and safe path to the front entrance of the retail and discourages walking around the district.



A single layer of casual parking and/or small buffers with landscape and amenities are idea of the neighborhood business district. The buildings, either single or mixed use, have a residential character and are arranged in ways that reflect the pattern of the surrounding residential neighborhoods.

Building Location & Parking General

Separate parking areas from outdoor seating and sidewalk areas by the use of stone walls and vegetation at a minimum of three feet in height.

The layout and design of all means of vehicular and pedestrian circulation, including interior drives, parking areas and walkways, shall provide for safe interior circulation and separation of pedestrian, vehicular and service traffic.

Where the portion of the property used for such parking abuts a street, such portion, excepting approved curb cuts, shall be separated from the street line by a curb at least six inches high.

Provisions for pedestrian movement, in the form of sidewalks or walkways, shall be made for all developments within a commercial area, to allow for safe access between parking areas and retail establishments.

Fixtures used to illuminate any parking facility shall be Friendly to reflect light away from adjoining properties or streets. Dark Sky cutoff lighting fixtures recommended.



The number of site entrances should be the minimum necessary for effective traffic control, and sharing of access driveways and parking areas by adjoining properties should be considered where possible. Such area shall have a dust-free hard surface, be provided with bumper barriers where needed and include facilities for managing stormwater runoff.

If parking area lies within or adjoins a residential area, provide a landscaped area containing an opaque fence four feet to six feet in height, or a double-row compact evergreen screen at least four feet in height, which shall be maintained in a neat and attractive manner between the parking facility and the adjoining residential area.

Parking & Landscaping Large Lot - General



Where larger lots are allowable or likely (primarily in the Pedestrian Friendly District) special attention should be paid to the disposition of parking, landscaping and pedestrian access through large parking fields. The following guidelines offer suggestions that not only improve the pedestrian and patron experience but also help developers and owners manage the stormwater and heat island challenges often present in large lot parking areas. Special attention should be paid to the width and depth of any planting islands to ensure long term viability of the plantings. Planted species should be chosen for durability and resilience in a heavy traffic areas.





Traditional storefronts enter directly off the sidewalk.

Entry Location

Retail is entered directly from a pedestrian way against the building.

The entry to ground floor retail shall serve both pedestrians and off-street parking, where it exists on site. A corner entry may be used where it serves both pedestrians and a parking area to the side or front.

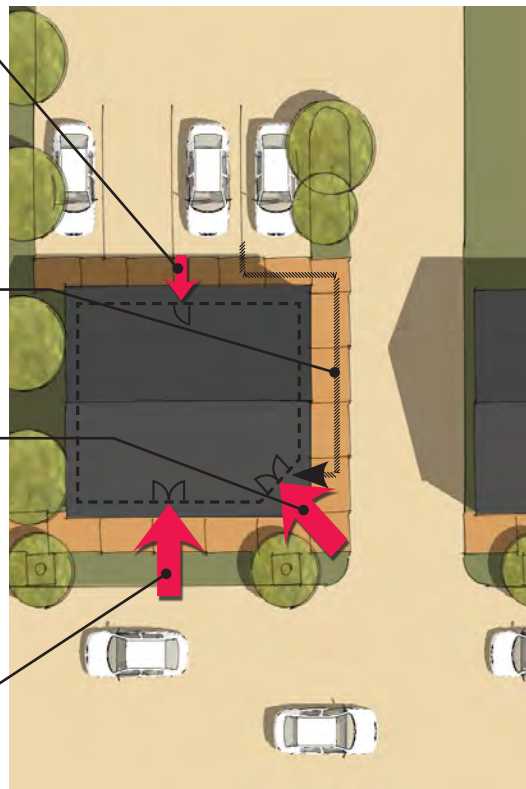
DO

Secondary entrance / exits may be located facing the rear parking area, but retail entrances should never solely be located at the rear.

Provide a clear walking path from any parking area to the front entrance.

A corner entrance can provide both main thoroughfare entry as well as access from rear or side yard parking.

Retail entrances should always be located fronting the main thoroughfare.



Recommended entry location(s) on a retail site.

Key Points

- The entry to retail should be obvious and convenient.
- Retail entries should be located directly off the sidewalk or interior pedestrian way
- See “Distinguishable Entries” section for more on retail entries and doors.



Retail / commercial storefronts and entrances should front the public way and should always open onto a pedestrian way.

AVOID



Avoid locating the primary entry at the rear of a building, regardless of its proximity to a rear parking area.



Separate retail and residential entries express their individual purposes.

Distinguishable Entries

In a mixed-use, separate entries express the retail and residential uses.

Public entries for commercial and retail uses are defined by a large scale and glazing. Private entries for residential uses are smaller in scale, according to their use.

DO

Awnings and canopies are encouraged. See "Awnings".

Large scale and maximum glazing defines the public entry.

The residential entry should be that of a smaller scale, befitting its role as a private entrance.



A large storefront entrance welcomes the public while a smaller residential entry is private for residents and their guests.

Key Points

- Entries to retail and commercial uses should be prominent and large in scale to be clearly identifiable to the public. See "Retail Doors".
- Awnings and canopies over storefront entries are encouraged. See "Awnings".
- Residential entries should be separate from public entries. The location may be less prominent and smaller in scale than for retail entries.
- Residential entries should have their own address separate from the retail.

AVOID



Public entries that are poorly defined or difficult to locate.



Residential entries that are not expressed with dignity. Residential entries that lack an individual address.

Storefronts

Ground-level retail draws shoppers and enlivens the sidewalk.

Large displays on a storefront can entice passers-by and invite them into a store. Visibility is important to make potential customers aware of a store's offering and create a sense of welcome.

Glazing area is approximately 70% of ground floor elevation.



DO

Sign Band.

Optional transoms.

Clear glazing area is approx. 70% of ground floor elevation.

Optional signage on glass - to be legible from across the street.



Sign lights with full cut-off to minimize light pollution.

Clear-glazed door fronting on the sidewalk.

Durable material, such as stone, to meet the ground.



Transparency of a storefront invites customers by letting them know what is offered and if the shop is welcoming business.



Key Points

- Ideally, storefronts should contain approximately 70% clear glazed area for the display of goods and services.
- Displays should allow a view through to the sales floor for customers to easily see whether the shop is open.

AVOID



Opaque façades do not invite commercial activity.



Blank walls and windows are uninteresting and shoppers may pass on by.



Traditional storefronts are architectural compositions designed to frame services and merchandise.

Retail Windows

Storefronts are composed with vertical proportions.

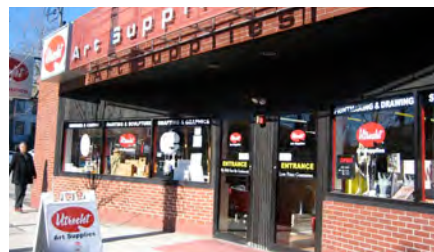
Retail storefronts were traditionally composed of small panes combined with muntins and mulls into larger windows. The panes were friendly vertically for strength and to reduce structural spans.

DO



Vertical window proportions allow a traditional structural system with short spans and vertical piers to carry imposed loads to the ground.

AVOID



Horizontal window bands rely on hidden structural beams to span long openings. These arrangements lack visual support for the stories above.

Key Points

- Each window pane and opening should have a square or vertical proportion.
- Square or vertical window elements may be further sub-divided into vertical panes.



Storefront doors allows views into and out of the shop to invite passers-by into an establishment.

Retail Doors

Clear-glazed doors allow views and invite customers.

Retail doors are traditionally clear-glazed so that the door is not a visual barrier to the store. The transparency allows views into the store, which is inviting and welcoming for shoppers.

DO



Retail doors should have clear glass and enter directly from the street.



Clear glazed doors allow views and invite shoppers to feel welcome and safe.



Key Points

- Retail doors should enter at street level directly off the sidewalk. Where parking is on the side of a store, a corner entry may serve both pedestrian and vehicular traffic.
- Doors should be clear glazed to allow views into and out of the store. This visibility is inviting, provides security and prevents collisions.

AVOID



Solid doors obstruct views - customers may be reluctant to enter.



Screen doors appear residential - to enter would be an intrusion.



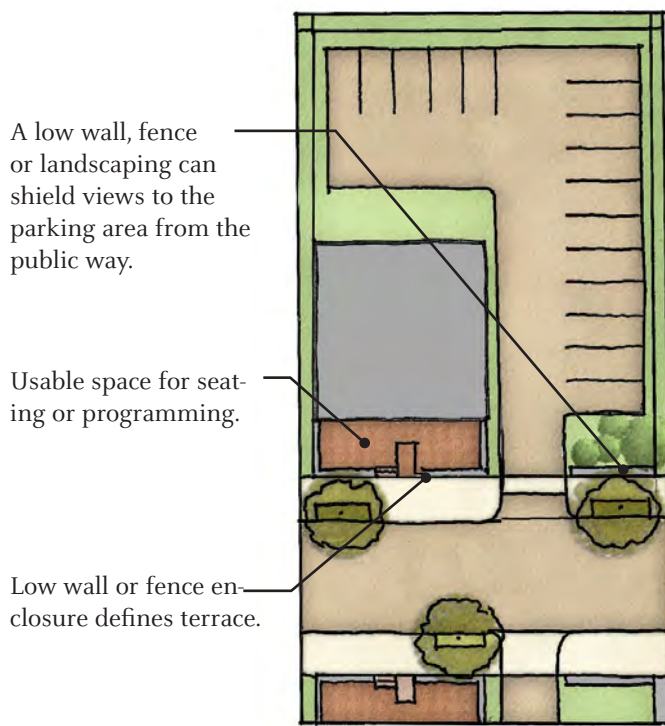
Landscaping can make spaces more usable.

Landscaping

Landscaping at retail buildings contributes to the public realm.

Retail landscaping can be used to create usable spaces on the exterior of the building, such as plazas and terraces. On retail streets, landscaping can also continue a street edge interrupted by parking.

DO



The space within a retail setback must be designed and programmed to maintain the connection between the street and store.

Key Points

- A low wall or fence can define the area in front of a retail building so that it may be used for dining or other programming.
- If parking is located to the side of a retail building, a low wall or fence can shield the parking area from view from the public way.
- Hardscaping is essential to making outdoor space usable.
- Planting on retail streets should be limited to tree wells, planter boxes and pots. Planting beds may be used to soften parking areas at the side and rear of retail buildings.

AVOID



Undefined or unprogrammed spaces in front of set-back retail buildings become unusable zones or parking lots.



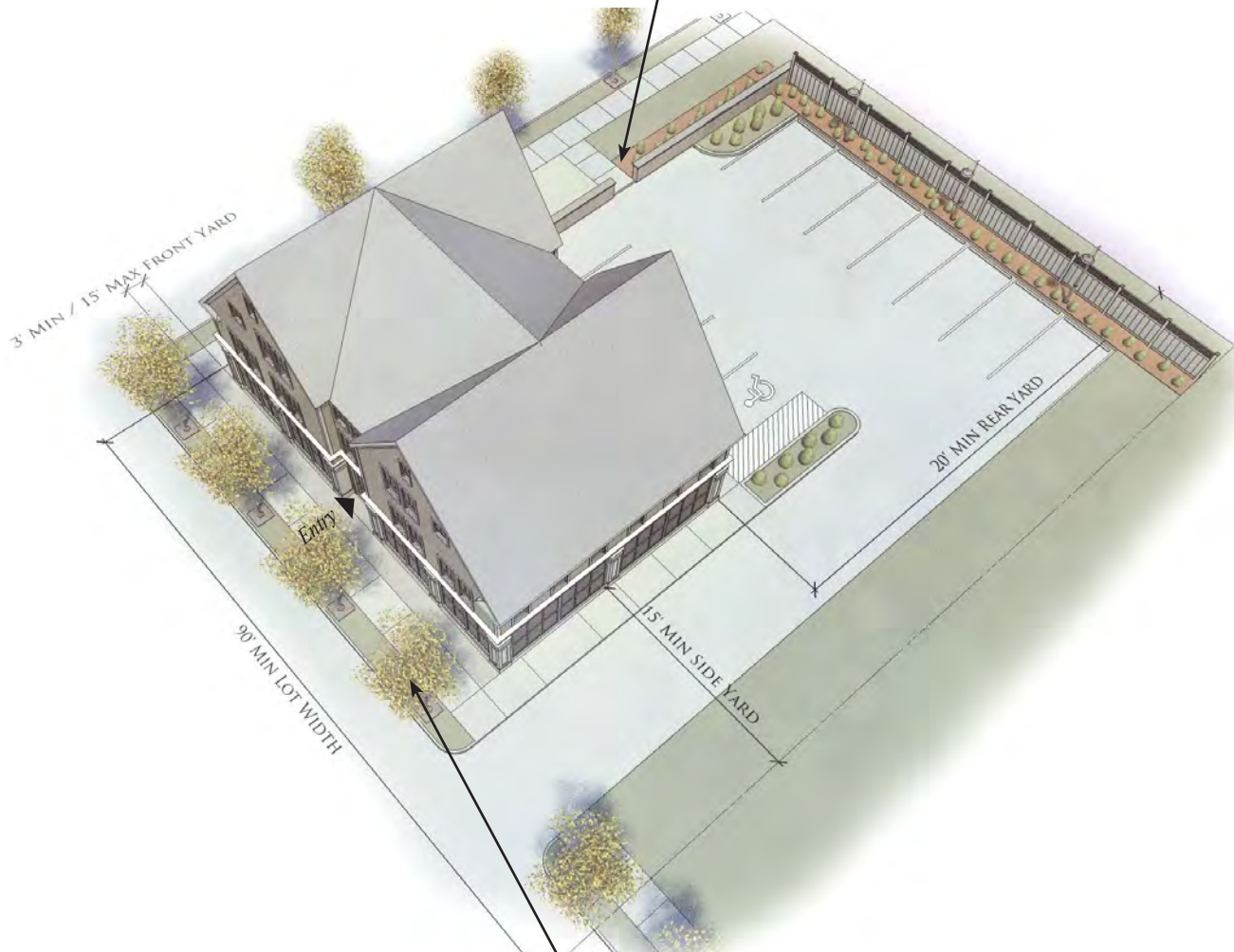
Residential foundation plantings force pedestrians away rather than inviting them to view wares.



Large expanses of parking exposed to the public way creates dead-zones that are unpleasant for pedestrians.

Landscaping (continued)

Parking lots which front on public streets shall be screened by landscaping or with walls or fencing a minimum of three feet in height. Walls and fences shall be of a scale and material appropriate to the site and surrounding area. In the PFD, this shall be in addition to the 3-foot minimum pedestrian buffer.



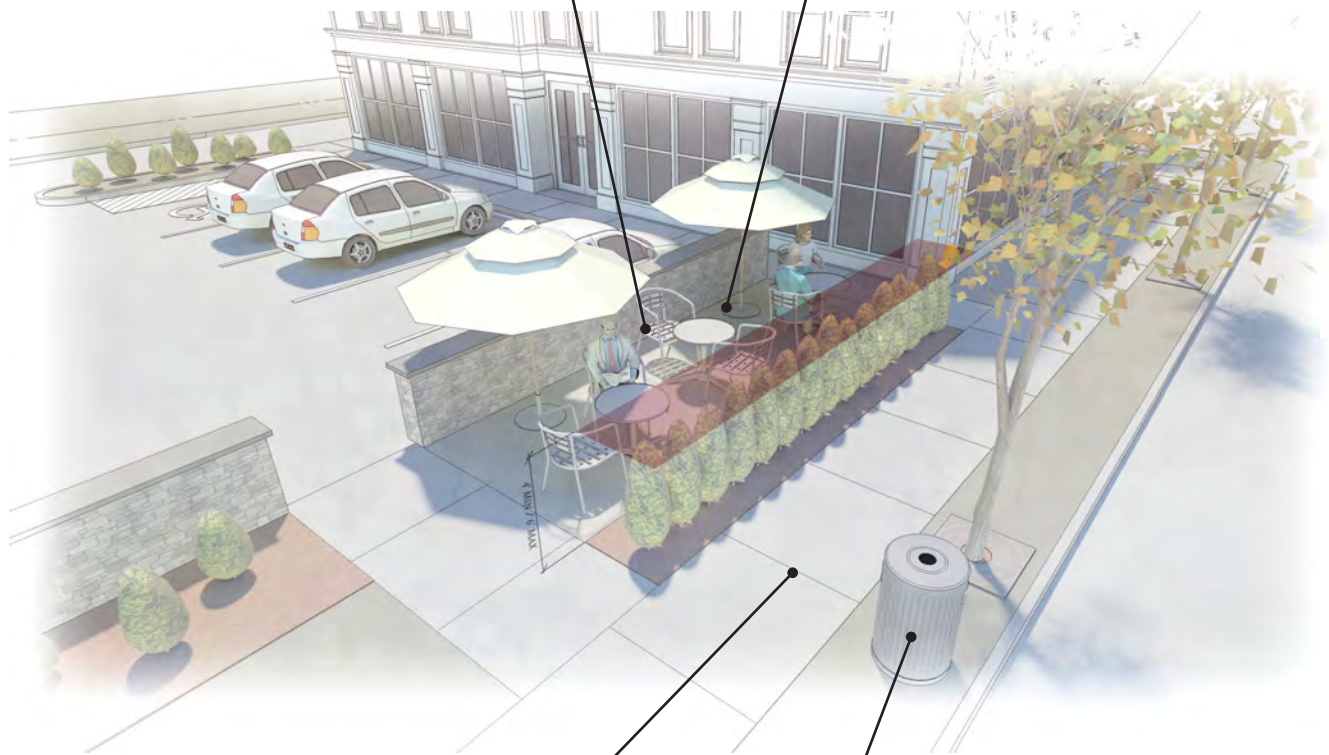
Landscape treatment shall be provided to enhance architectural features and improve aesthetics, and the site shall be planned to achieve a desirable transition between the building and the street, with the use of pedestrian walkways, special lighting, benches and other amenities encouraged.

Outdoor Seating

Landscaped terrace areas can provide for outdoor uses.

The outdoor seating area shall be screened from parking, and demarcated from sidewalks and/or street by a landscaping strip, plants or fencing four to six feet in height. All such screening materials must be secured so as not to create a hazard.

Outdoor seating areas shall be distinguished from parking areas by solid, uninterrupted concrete or granite curbs and landscaping which physically separates the outdoor seating area from parking.



Outdoor seating or display shall not block handicapped or pedestrian access.

There shall be at least one readily visible litter barrel.

Signage: General

Signage is a signature and invitation from the shop.

Retail signage is an important component to the storefront composition and the streetscape. Appropriate signage provides advertising for a business and information to potential customers.



Beautiful signage is critical for the success of a business and a streetscape.

DO

Sign band with attached, painted or engraved lettering.

Blade signs with attached, painted or engraved lettering.

Lettering printed on awning fringe.

Window lettering painted or applied vinyl.



Pedestrian-scaled signs of quality materials can provide the required marketing and contribute to the character of the main street.



Key Points

- Retail signage may include a sign band, blade sign, awning lettering and window lettering.
- Signage should be scaled and Friendly to the pedestrian. Generally, all signage should occur below the second floor.
- Sign materials should reflect the character of the main street. Wood and metal signs are encouraged. Avoid using plastic, vinyl and other synthetic materials that are not traditional in character.

AVOID



Large marquee, oversized signs and signs above the first story are distracting and Friendly to fast-moving traffic.



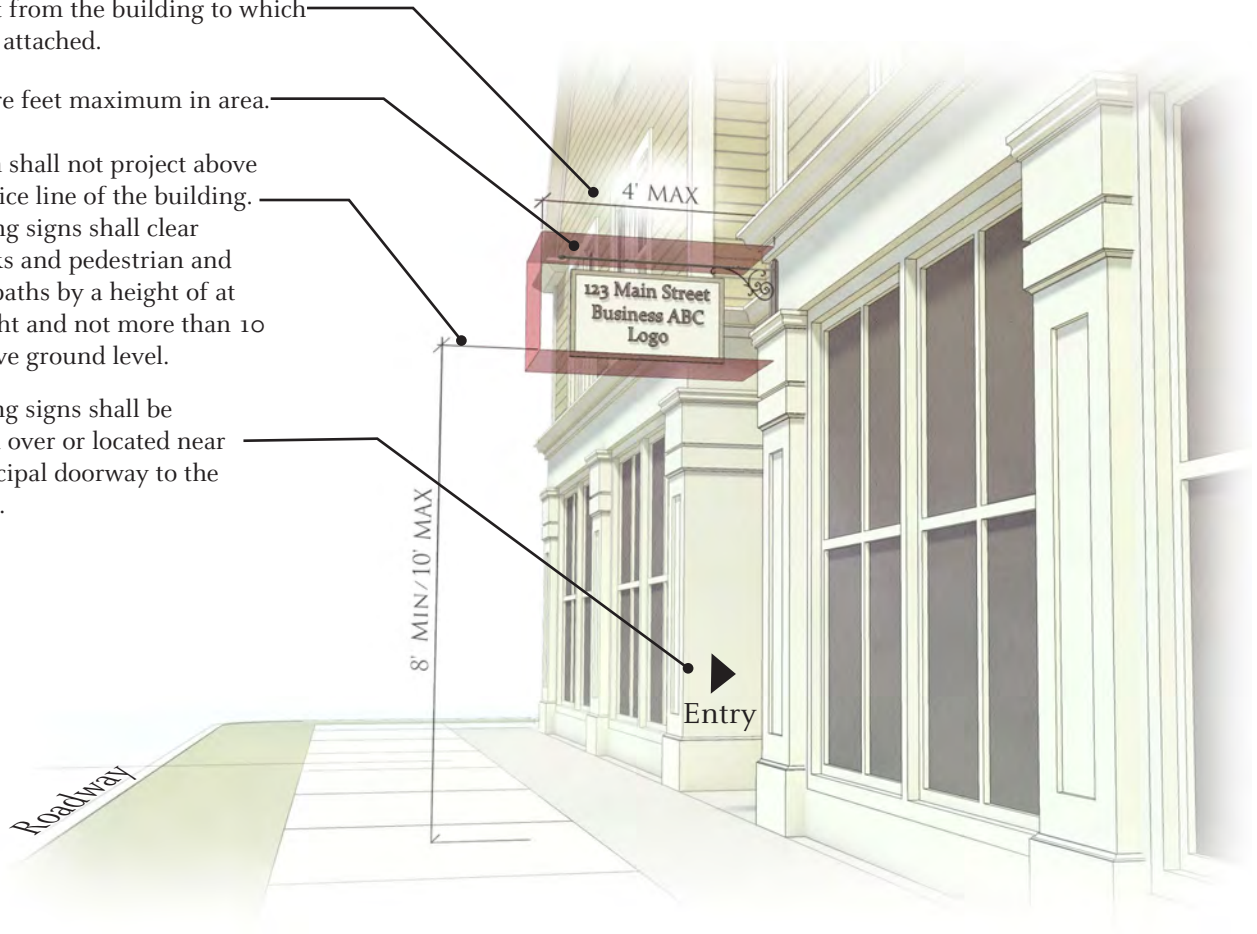
Signage: Projecting from Building

The sign shall project no more than four feet from the building to which they are attached.

16 square feet maximum in area.

The sign shall not project above the cornice line of the building. Projecting signs shall clear sidewalks and pedestrian and bicycle paths by a height of at least eight and not more than 10 feet above ground level.

Projecting signs shall be centered over or located near the principal doorway to the building.



Key Points

- The façade of the building to which the sign is attached shall be no more than 10 feet from the paved portion of any street or right-of-way used for travel purposes.
- The content of the signs should include only the building’s street number, the name of the business, a business logo and/or product or service information.
- Projecting signs shall not overhang into any roadway or create a hazard to pedestrians.

AVOID



Projecting signs located at building corners where they do not meet perpendicular to the building facade.

Signage: Window

Whenever possible, such window signs should be located on the window beside the primary business entrance.

Permanent window signs indicating the name and/or logo of the business, the nature of the business, the hours and days of business, the credit cards honored and/or other information related to the business establishment or activity may be painted on or affixed to the inside of one window of the business. Such information should not cover more than 25% of the total window area located on the front of the building.





Canvas awnings can increase comfort by shielding unwanted sun or rain.

Awnings

Awnings protect window shoppers from sun and rain.

Storefront awnings provide some control of weather influences at the entrance to a store. Offering shelter from the rain or sun can attract pedestrians to window shop and eliminate unwanted glare.

DO



Key Points

- Canvas awnings on retractable metal frames provide the greatest control over sunlight and rain.
- Store signage should be located on the fringe of the awning.
- Sloped awnings are preferred over rounded styles.

Retractable metal frame.

Canvas awning.

Signage on fringe.

AVOID



Barrel-shaped or rounded awnings.



Metal or other non-traditional materials.



Retractable canvas awnings can be retracted or spread depending on the weather.



Storefront lighting can be integrated with the design and character of the storefront and signage.

Lighting

Lighting provides safety and extends hours after dark.

Retail lighting is essential for creating safe and welcoming streets so that retail stores can extend operating hours after sunset. Retail lighting can add a dramatic effect to signage after dark.

DO

Wall mounted and goose-neck fixtures are appropriate for lighting sign bands.

Blade signs may have directional pendant lighting.

A ceiling mounted fixture may illuminate recessed entries.



Gooseneck and pendant lighting can be directed to illuminate signage at night for advertising, way finding and safety.



Key Points

- Retail lighting should be directed towards the merchandise, signage and pedestrian way.
- Directional lighting and cut-offs should be employed to reduce light pollution escaping into the night sky.
- Gooseneck, sconce and pendant lighting styles may be appropriate. Avoid neon lights and back lighting.

AVOID



Neon and back-lit signs create undesirable glare and light pollution. Signs with electronic displays are distracting and are also discouraged.

RIGHTS OF WAY DESIGN GUIDELINES

The rights of way improvements for Main Road and the Bliss Four Corners are designed to improve the overall quality of travel. More specifically, these improvements seek to improve aesthetic quality, calm traffic, increase on-street parking, improve pedestrian circulation, and facilitate the flow of traffic.

The list of improvements includes a roundabout at Bliss Four Corners as well as medians, on-street parking and center turn lanes on Main Road. In addition to these primary recommended improvements, there are multiple opportunities to improve pedestrian and vehicular accommodations on both Main Road and at Bliss Four Corners through a number of roadway and pedestrian enhancement measures. Those measures are outlined within the design guidelines presented here.

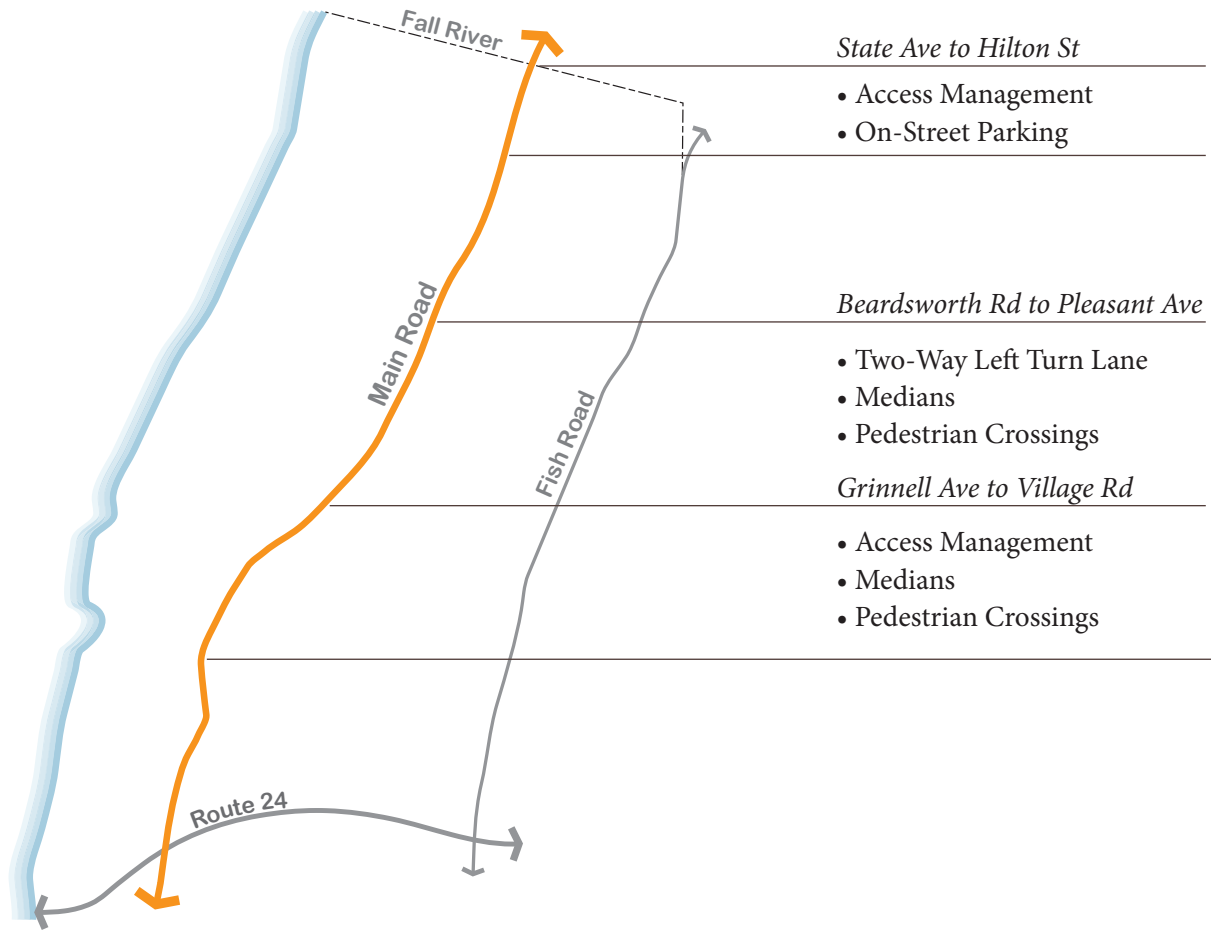
It is recognized that the public ways in these districts are owned by the State of Rhode Island. Improvements therefore require state approval. Knowledge of best practices help coordinate the design of private land adjacent to the public way and link improvement that may be proposed within the rights of way.

Following general recommendations for rights of way on Main Road and Bliss Four Corners, specific design guidelines are given for aspects of street design and transportation:

- Street design
- Street users
- Pedestrian realm
- Pedestrian crossings
- Marked crosswalks
- Crosswalk and ramp placement
- Curb ramps
- Intersections
- Intersection geometry
- Roadway elements
- Roundabouts

Main Road Primary
Recommended
Transportation
Improvements

Main Road is composed of several segments of varying roadway widths and land uses. At the north of the corridor, between State Avenue and Hilton Street, the roadway is relatively narrow, yet wide enough to accommodate on-street parking if access management is applied to the many driveways and curb cuts. The middle segment of Main Road, from Beardsworth Road to Pleasant Avenue, is relatively wide with many driveways for adjacent residences. This segment of the roadway could be converted to a three lane cross section with a two-way left turn lane at the center of the roadway. The southern segment of the roadway from Grinnell Avenue to Old Main Road is also wide, although with fewer curb cuts. This segment of the roadway could readily accommodate medians at the center of the roadway. A median treatment would be effective in calming traffic and improving the appearance of the roadway.



Main Road: State Avenue to Hilton Street

Recommendations for Main Road between State Avenue and Hilton Street include the provision of dedicated on-street parking. Parking could be provided on one side of the street if conflicting driveways are consolidated or eliminated. Access to the rear of properties can be provided via existing alleys, which would make the elimination of curb cuts and driveways feasible. On-street parking is a valuable asset in this location due to several storefronts and demand for on-street parking. The provision of an 8' wide parking lane would require travel lanes to be reduced to 11' which would create a traffic calming effect. This roadway profile meets Rhode Island DOT (RIDOT) standards, which has established a minimum travel lane width of 11' and a minimum parking lane width of 8' for state roadways.

Pedestrian crossings in this area are critical due to the foot traffic created by storefronts. See the street design guidelines for guidance on pedestrian crossing location and design.

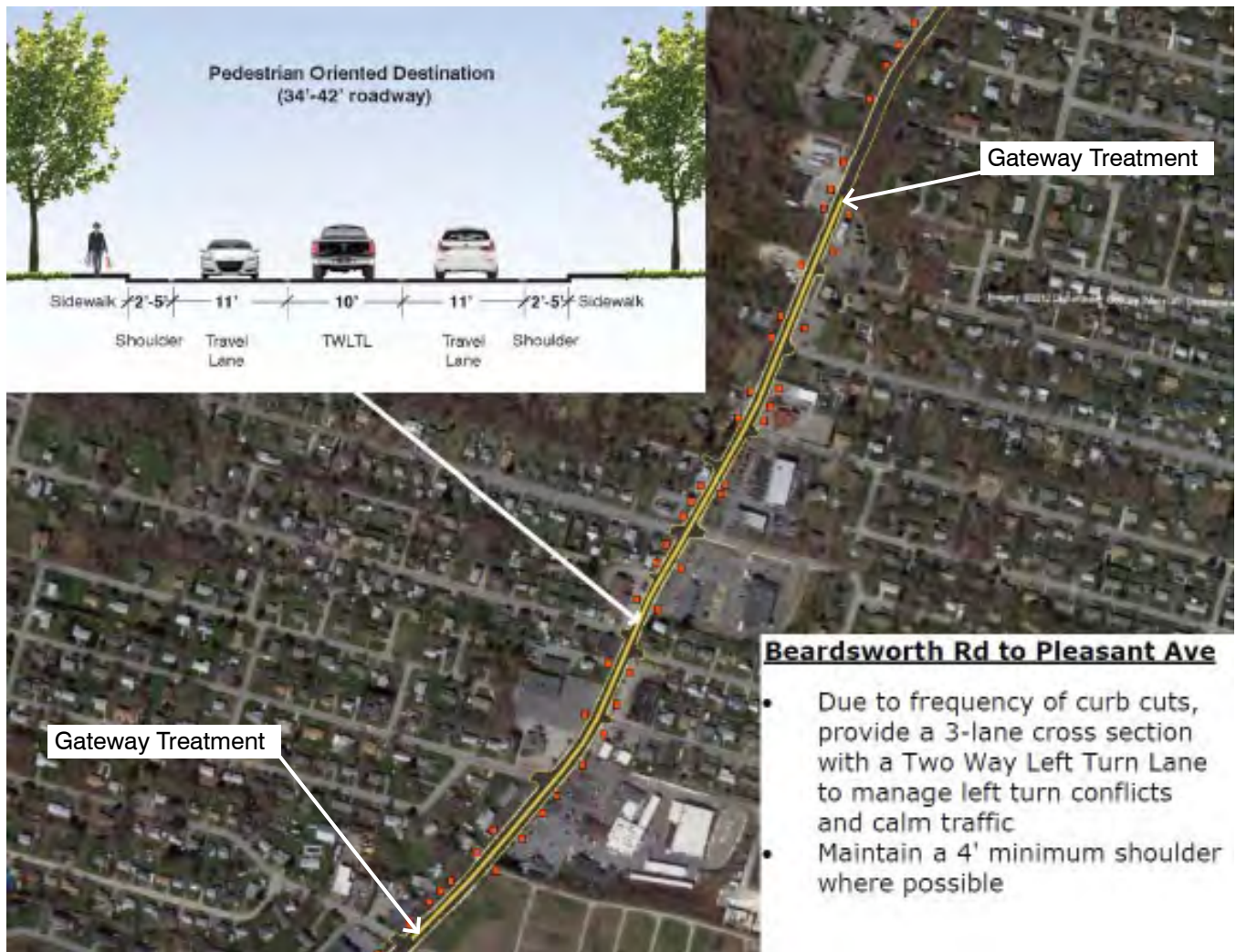


**Main Road:
Beardsworth Road to
Pleasant Avenue**

A two-way left turn lane (TWLTL) is recommended on Main Road between Beardsworth Road and Pleasant Avenue. This turn lane would accommodate turning demand for the multiple driveways located on this segment of roadway and reduce collisions thereby improving safety. According to a 2008 Federal Highways Administration study, TWLTLs are effective in reducing collisions by 19-47%. TWLTLs added to two-lane roadways have been proven to be a cost-effective traffic calming treatment.

The proposed TWLTL for Main Road is 10' wide with 11' travel lanes and shoulders that vary from 2' to 5'. RIDOT specifies a minimum median lane width of 12' for TWLTLs, although 10' is a minimum standard in many other jurisdictions. A design exception would be required for the 10' lane width. The median lane width could be expanded to 12' by reducing shoulder width on each side by one foot if an exception is not granted.

Median islands can be incorporated into the TWLTL concept as a gateway treatment approaching this area and as a means of assisting pedestrian crossings and improving the appearance of the roadway.



**Main Road:
Grinnell Avenue to
Village Road**

Main Road from Grinnell Avenue to Village Road varies in width from 36' to 40' and has relatively few curb cuts. Due to the roadway geometry, traffic calming is needed to manage traffic speeds. A median island is recommended as a means of calming traffic and improving the visual appearance of the roadway. The median island would be accompanied by 11' travel lanes and 3-4' wide shoulders that would provide separation between the roadway and adjacent sidewalks. The median island can also be used to assist pedestrian crossings and crossings should be provided where conditions support their installation. While there are relatively few curb cuts on this segment of Main Road, consolidation of driveways and a reduction of curb cuts would further improve pedestrian safety and traffic flow.

This recommended roadway profile meets Rhode Island DOT standards.

Grinnell Ave to Village Rd

- Minimize curb cuts with access management policy
- Develop raised or flush median to narrow travel lanes and calm traffic
- Develop median breaks at intersection and major driveways
- Provide pedestrian crossings where appropriate
- Maintain 4' minimum shoulder where possible

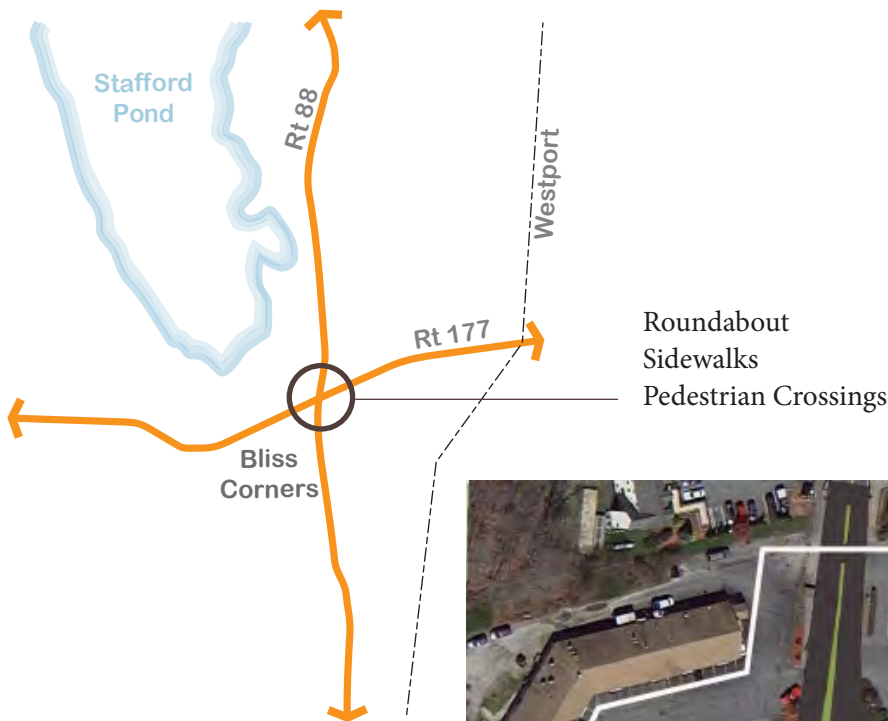


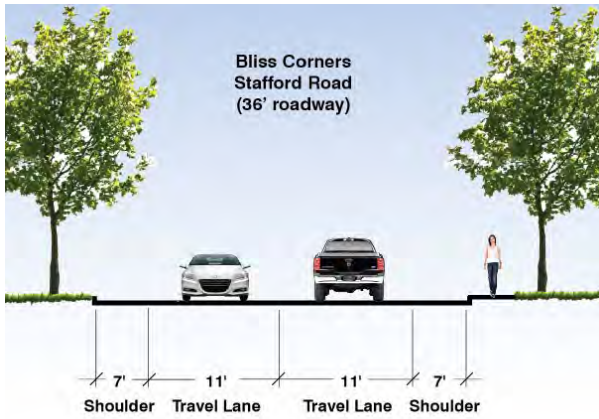
Bliss Four Corners Primary Recommended Transportation Improvements

Bliss Four Corners, at the intersection of Route 177 and Route 88, is a skewed intersection. Because of this geometric design, the intersection does not function well and pedestrian crossings are long and inconvenient. Given its function as a retail/commercial area, the intersection should be improved to facilitate pedestrian movement between businesses and the flow of traffic through the area.

A roundabout has been recommended by the State at this location as a means of facilitating the flow of traffic, improving the appearance of the area, and providing additional opportunities for pedestrian circulation. Pedestrian circulation can be improved by providing an internal circulation system within the commercial developments that are connected by pedestrian crossings at all four legs of the intersection.

Specific guidance for roundabout design and the design of pedestrian facilities at roundabouts is provided in the design guidelines.





The construction of a roundabout at Bliss Four Corners provides an opportunity to improve pedestrian circulation in this area. While sidewalks are typically located within the right-of-way, shifting pedestrian circulation to private commercial properties would provide a direct connection to storefronts and separate pedestrians from traffic flow. Additionally, locating pedestrian crossings away from the roundabout intersection would simplify crossings and would potentially provide safer crossing locations.

Additionally, a pedestrian crossing is recommended on Stafford Road approximately 800' north of Bliss Four Corners.



Stafford Road

- Construct modern roundabout at intersection
- Install mid-block pedestrian crossing along Stafford Rd
- Provide left turn pockets as development intensifies
- Narrow travel lanes to calm traffic

STREET DESIGN

The geometric design of streets has traditionally focused on the movement of motor vehicles, resulting in street environments that neglect other users. This emphasis can be seen in wide travel lanes, large corner radii, and turn lanes that severely impede the safety of pedestrians and the overall connectivity for non-automobile users. The geometric design of the roadways and intersections has usually reflected the need to move traffic as quickly as possible. A paradigm shift needs to occur to reclaim the public right-of-way for pedestrians and bicyclists and create living streets.

Streets are composed of several zones and are capable of accommodating many different users. The term “street” references the entire environment within the right-of-way. A typical street is further divided into the roadway and the pedestrian realm. The roadway includes travel lanes, turning lanes, parking lanes, median islands and intersections. The pedestrian realm is composed of the furniture zone, the sidewalk, and the frontage zone. The pedestrian realm also traverses the roadway and hence the pedestrian crossing and its various components including the curb ramp and crosswalk.



*The many functions and components of a street
(Credit: Project for Public Spaces)*

STREET USERS

Pedestrians

Walking is the most basic mode of transportation, yet pedestrians are often ignored in roadway design. Certain areas generate high pedestrian activity, such as downtowns, residential, commercial, and entertainment areas, and schools. Yet even in areas of low pedestrian activity, such as along commercial strip-developed arterials, pedestrian needs and safety must be addressed, as drivers usually don't expect pedestrians, who are more vulnerable if a crash occurs. Much of this is due to speed. As speeds increase, drivers are less attentive to what is happening on the side of the road, reaction time is increased, and the pedestrian has a higher chance of dying or becoming severely injured in case of a crash.

Most pedestrian crashes occur when a person crosses the road, and the most common crash type is a conflict between a crossing pedestrian and a turning vehicle at an intersection.

But designing for pedestrians should not focus primarily on avoiding crashes; the goal of roadway and intersection design should be to create an environment that is conducive to walking, where people can walk along and cross the road, where the roadside becomes a place where people want to be. The two most effective methods to achieve these goals are to minimize the footprint dedicated to motor vehicle traffic and to slow down the speed of moving traffic. This approach allows the designer to use many features that enhance the walking environment, such as trees, curb extensions, and street furniture, which in turn slow traffic: a virtuous cycle. All streets should have sidewalks except for rural roads and shared-space streets.



*Walking-aid users need clear sidewalks
(Credit: Dan Burden)*

People with Mobility Impairments

People with mobility impairments range from those who use assistive devices, such as wheelchairs, crutches, canes, orthotics, and prosthetic devices, to those who use no such devices but face constraints walking long distances on non-level surfaces or on steep grades.

Wheelchair and scooter users are most affected by the following:

- Uneven surfaces that hinder movement
- Rough surfaces that make rolling difficult and can cause pain, especially for people with back injuries
- Steep uphill slopes that slow the user
- Steep downhill slopes that cause a loss of control
- Cross slopes that make the assistive device unstable
- Narrow sidewalks that impede the ability of users to turn or to cross paths with others
- Devices that are hard to reach, such as push buttons for walk signals and doors
- The lack of time to cross the street

Walking-aid users are most affected by the following:

- Steep uphill slopes that make movement slow or impossible
- Steep downhill slopes that are difficult to negotiate
- Cross slopes that cause the walker to lose stability
- Uneven surfaces that cause these users to trip or lose balance
- Long distances
- Situations that require fast reaction time
- The lack of time to cross the street

Prosthesis users often move slowly and have difficulty with steep grades or cross slopes.



*Sight-impaired pedestrians need additional sensory cues
(Credit: Dan Burden)*

People with Visual Impairments

People with visual impairments include those who are partially or fully blind, as well as those who are colorblind. Visually impaired people face the following difficulties:

- Limited or no visual perception of the path ahead
- Limited or no visual information about their surroundings, especially in a new place
- Changing environments where they rely on memory
- Lack of non-visual information
- Inability to react quickly
- Unpredictable situations, such as complex intersections that are not at 90 degrees
- Inability to distinguish the edge of the sidewalk from the street
- Compromised ability to detect the proper time to cross a street
- Compromised ability to cross a street along the correct path
- Need for more time to cross the street

Children and Older Adults



Children and many older adults don't fall under specific categories for disabilities, but must be taken into account in pedestrian planning. Children are less mentally and physically developed than adults and have the following characteristics:

- Less peripheral vision
- Limited ability to judge speed and distance
- Difficulty locating sounds
- Limited or no reading ability so don't understand text signs
- Occasional impulsive or unpredictable behavior
- Little familiarity with traffic
- Difficulty in carrying packages
- Small children are also more difficult to see than adults.

To provide a seamless path of travel throughout the community that is accessible to all, designers should consider five important elements: sidewalks, curb ramps, crosswalks, signals, and bus stops.

Bicyclists

Streets should be designed with the expectation that bicyclists will use them. This does not mean every street needs a dedicated bicycle facility, nor will every road accommodate all types of bicyclists. Minimizing the footprint dedicated to motor vehicle traffic and slowing down the speed of moving traffic benefits bicyclists.





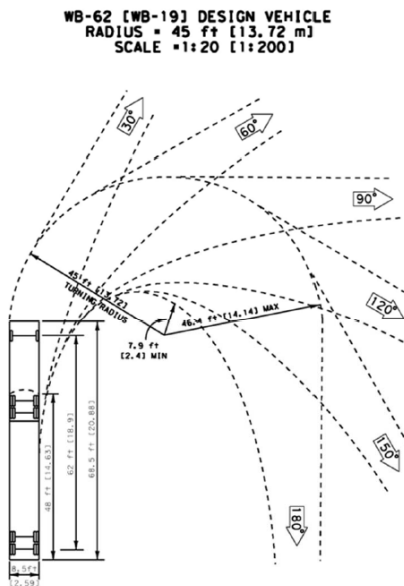
(Credit: Ryan Snyder)

Public Transportation

Designing for transit vehicles on roadways takes into consideration many factors. Buses have operational characteristics that resemble trucks - they usually operate in mixed traffic, they stop and start often for passengers, and they must be accessible to people boarding the bus. The consequences for roadway design include lane width (in most cases buses can operate safely in travel lanes designed for passenger cars), intersection design (turning radius or width of channelization lane), signal timing (often adjusted to give transit an advantage—queue jumping), pedestrian access (crossing the street at bus stops), sidewalk design (making room for bus shelters in the furniture zone), and bus stop placement and design (farside/nearside at intersections, bus pullouts, or bulb outs).

Design Vehicles

The design vehicle influences several geometric design features including lane width, corner radii, median nose design, and other intersection design details. Designing for a larger vehicle than necessary is undesirable, due to the potential negative impacts larger dimensions may have on pedestrian crossing distances and the speed of turning vehicles. On the other hand, designing for a vehicle that is too small can result in operational problems if larger vehicles frequently use the facility.



Designing for truck traffic:
The WB-62 Design Vehicle

For design purposes, the WB-40 (wheel-base 40 feet) is appropriate unless larger vehicles are more common. On bus routes and truck routes, designing for the bus (CITY-BUS or similar) or large truck (either the WB-50 or WB-62 design vehicle) may be appropriate, but only at intersections where these vehicles make turns. For example, for intersection geometry design features such as corner radii, different design vehicles should be used for each intersection or even each corner, rather than a “one-size-fits-all” approach, which results in larger radii than needed at most corners. The design vehicle should be accommodated without encroachment into opposing traffic lanes. It is generally acceptable to have encroachment onto multiple same-direction traffic lanes on the receiving roadway.

Furthermore, it may be inappropriate to design a facility by using a larger “control vehicle,” which uses the street infrequently, or infrequently makes turns at a specific location. An example of a control vehicle is a vehicle that makes no more than one delivery per day at a business. Depending on the frequency, by under designing the control vehicle can be allowed to encroach on opposing traffic lanes or make multiple-point turns.



Design Speed

The application of design speed for living streets is philosophically different than for conventional transportation practices. Traditionally, the approach for setting design speed is to use as high a design speed as practical. This has many negative effects. Speed kills places as well as people, and places efficiency over access. Because high design speeds reduce access to places on foot, they degrade the social and retail life of a street and devalue the adjacent land. Local economies thrive on attracting people.

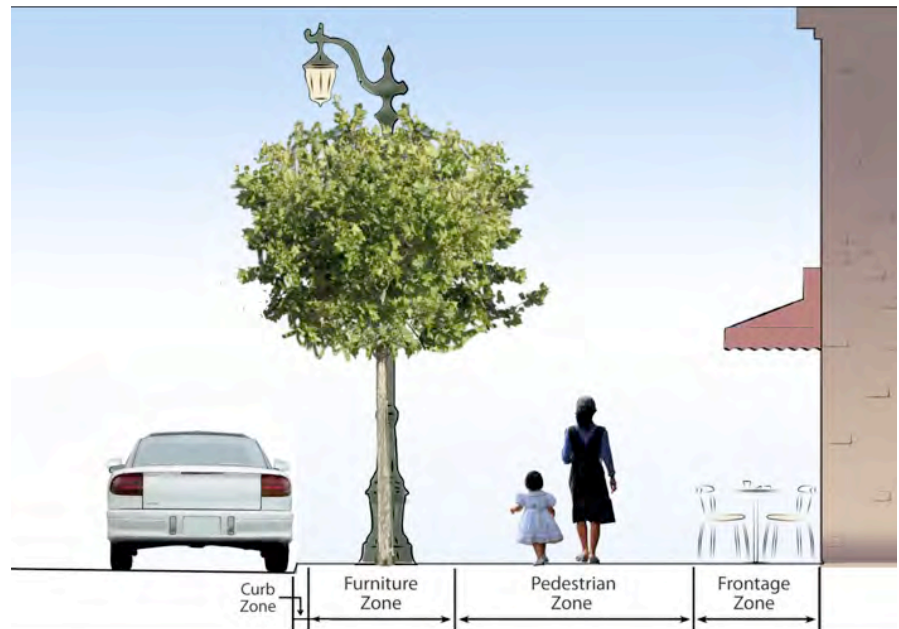
In contrast to this approach, the goal for living streets is to establish a design speed that creates a safer and more comfortable environment for motorists, pedestrians, and bicyclists. This approach also increases access to adjacent land, thereby increasing its value, and therefore is appropriate for the surrounding context. For living streets, design speeds of 20 to 35 mph are desirable. Alleys and narrow roadways intended to function as shared spaces may have design speeds as low as 10 mph. Design speed does not determine nor predict exactly at what speed motorists will travel on a roadway segment; rather, design speed determines which design features are allowable (or mandated). Features associated with high-speed designs, such as large curb radii, straight and wide travel lanes, ample clear zones (no on-street parking or street trees), guardrails, etc., degrade the walking experience and make it difficult to design living streets. In the end, the design of the road encourages high speeds and creates a vicious cycle. A slower design speed allows the use of features that enhance the walking environment, such as small curb radii, narrower sections, trees, on-street parking, curb extensions, and street furniture, which in turn slow traffic: a virtuous cycle.

PEDESTRIAN REALM



The pedestrian realm, commonly referred to as the sidewalk, is composed of several spaces or zones. Sidewalks provide a comfortable space for pedestrians between the roadway and adjacent land uses. Sidewalks along city streets are the most important component of pedestrian mobility. They provide access to destinations and critical connections between modes of travel, including automobiles, transit, and bicycles. General provisions for sidewalks include pathway width, slope, space for street furniture, utilities, trees and landscaping, and building ingress/egress.

Sidewalks include four distinct zones: the frontage zone, the pedestrian (aka walking) zone, the furniture zone, and the curb zone. The minimum widths of each of these zones vary based on street classifications as well as land uses. The Street Classifications section in this chapter describes these recommendations in more detail as applied to individual cities. The table at the end of this chapter recommends minimum widths for each zone for different street types and land uses.

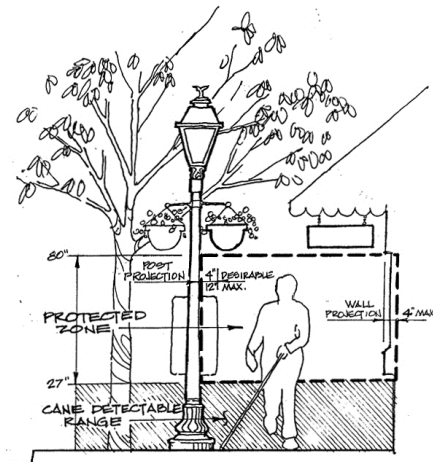


The different zones of the Pedestrian Realm

Frontage Zone

The frontage zone is the portion of the sidewalk located immediately adjacent to buildings, and provides shy distance from buildings, walls, fences, or property lines. It includes space for building-related features such as entryways and accessible ramps. It can include landscaping as well as awnings, signs, news racks, benches, and outdoor café seating. In single family residential neighborhoods, landscaping typically occupies the frontage zone.

Pedestrian Zone



The Pedestrian Zone

The pedestrian zone, situated between the frontage zone and the furniture zone, is the area dedicated to walking and should be kept clear of all fixtures and obstructions. Within the pedestrian zone, the Pedestrian Access Route (PAR) is the path that provides continuous connections from the public right-of-way to building and property entry points, parking areas, and public transportation. This pathway is required to comply with ADA guidelines and is intended to be a seamless pathway for wheelchair and white cane users. As such, this route should be firm, stable, and slip-resistant, and should comply with maximum cross slope requirements (2 percent grade). The walkway grade shall not exceed the general grade of the adjacent street. Aesthetic textured pavement materials (e.g., brick and pavers) are best used in the frontage and furniture zones, rather than the PAR. The PAR should be a minimum of 4 feet, but preferably at least 5 feet in width to provide adequate space for two pedestrians to comfortably pass or walk side by side. All transitions (e.g., from street to ramp or ramp to landing) must be flush and free of changes in level. The engineer should determine the pedestrian zone width to accommodate the projected volume of users. In no case will this zone be less than the width of the PAR.

Non-compliant driveways often present significant obstacles to wheelchair users. The cross slope on these driveways is often much steeper than the 2 percent maximum grade. Driveway aprons that extend into the pedestrian zone can render a sidewalk impassable to users of wheelchairs, walkers, and crutches. They need a flat plane on which to rest all four supports (two in the case of crutches). To provide a continuous PAR across driveways, aprons should be confined to the furniture and curb zones.

Furniture Zone



The furniture zone is located between the curb line and the pedestrian zone. The furniture zone should contain all fixtures, such as street trees, bus stops and shelters, parking meters, utility poles and boxes, lamp posts, signs, bike racks, news racks, benches, waste receptacles, drinking fountains, and other street furniture to keep the pedestrian zone free of obstructions. In residential neighborhoods, the furniture zone is often landscaped. Resting areas with benches and space for wheelchairs should be provided in high volume pedestrian districts and along blocks with a steep grade to provide a place to rest for older adults, wheelchair users, and others who need to catch their breath.

Curb Zone

The curb zone serves primarily to prevent water and cars from encroaching on the sidewalk. It defines where the area for pedestrians begins, and the area for cars ends. It is the area people using assistive devices must traverse to get from the street to the sidewalk, so its design is critical to accessibility.

PEDESTRIAN CROSSINGS

Walking requires two important features in the built environment: people must walk along streets and they must get across streets. Crossing a street should be easy, safe, convenient, and comfortable. While pedestrian behavior and intersection or crossing design affect the street crossing experience, motorist behavior (whether and how motorists stop for pedestrians) is the most significant factor in pedestrian safety.

A number of tools exist to improve pedestrian safety and to make crossing streets easier. Effective traffic management can address concerns about traffic speed and volume. A motorist driving more slowly has more time to see, react, and stop for a pedestrian. The number of pedestrians also influences motorists; in general, motorists are more aware of pedestrians when more people walk. Most tools to address crossing challenges are engineering treatments, but tools from the enforcement, education, and planning toolboxes are also important.

Providing marked crosswalks is only one of the many possible engineering measures. When considering how to provide safer crossings for pedestrians, the question should not be: “Should I provide a marked crosswalk?” Instead, the question should be: “What are the most effective measures that can be used to help pedestrians safely cross the street?” Deciding whether to mark or not mark crosswalks is only one consideration in creating safe and convenient pedestrian crossings.



Principles of Pedestrian Crossings

This section describes a number of measures to improve pedestrian crossings, including marked and unmarked crosswalks, raised crossing islands and medians, and lighting.

The following principles should be incorporated into every pedestrian crossing improvement:

- Pedestrians must be able to cross roads safely. Cities have an obligation to provide safe and convenient crossing opportunities.
- The safety of all street users, particularly more vulnerable groups, such as children, the elderly, and those with disabilities, and more vulnerable modes, such as walking and bicycling, must be considered when designing streets.
- Pedestrian crossings must meet accessibility standards and guidelines.
- Avoid concurrent movements of motor vehicles and people at signalized intersections.
- People should never have to wait more than 90 seconds to cross at signalized intersections.
- Pedestrian signals should be provided at all signalized crossings where pedestrians are allowed.

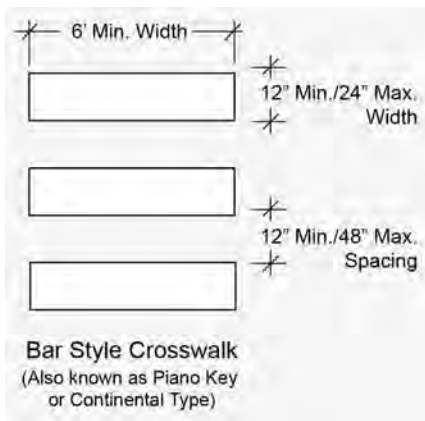
Marked Crosswalks



Crosswalks are present by law at all intersections, whether marked or unmarked, unless the pedestrian crossing is specifically prohibited. At mid-block locations, crosswalks only exist where marked. At these non-intersection locations, the crosswalk markings legally establish the crosswalk. Crosswalks should be considered at mid-block locations where there is strong evidence that pedestrians want to cross there, due to origins and destinations across from each other and an overly long walking distance to the nearest controlled crossing. Marked crosswalks alert drivers to expect crossing pedestrians and direct pedestrians to desirable crossing locations. Although many motorists are unaware of their precise legal obligations at crosswalks, the California Vehicle Code requires drivers to yield to pedestrians in any crosswalk, whether marked or unmarked. Marking crosswalks at every intersection is not necessary or desirable.

Crosswalk Markings

According to the MUTCD, the minimum crosswalk marking shall consist of solid white lines. They shall not be less than 6 inches or greater than 24 inches in width.



Placement

The best locations to install marked crosswalks are

- All signalized intersections
- Crossings near transit locations
- Trail crossings
- High land use generators
- School walking routes
- When there is a preferred crossing location due to sight distance
- Where needed to enable comfortable crossings of multi-lane streets between controlled crossings spaced at convenient distances

Controlled Intersections

Intersections can be controlled by traffic signals or STOP signs. Marked crosswalks should be provided on all intersection legs controlled by traffic signals, unless the pedestrian crossing is specifically prohibited. Marked crosswalks may be considered at STOP-controlled intersections. Factors to be considered include high pedestrian volumes, high vehicle volumes, school zone location, high volume of elderly or disabled users, or other safety related criteria.

Crosswalk and Ramp Placement

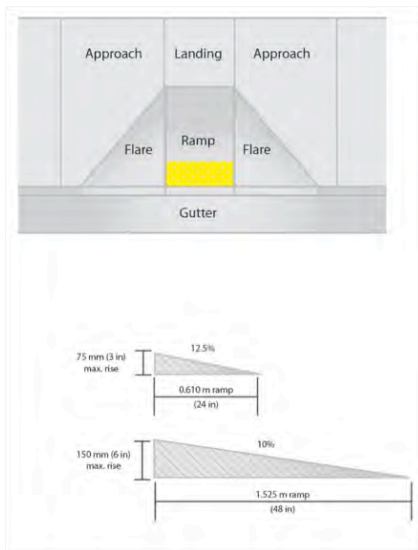


One curb ramp per crosswalk should be provided at corners. Ramps should align with sidewalks and crosswalks (Credit: Michele Weisbart)

Crosswalks and ramps at intersections should be placed so they provide convenience and safety for pedestrians. The following recommended practices will help achieve these goals:

- Allow crossings on all legs of an intersection, unless there are no pedestrian accessible destinations on one or more of the corners. Closing a crosswalk usually results in a pedestrian either walking around several legs of the intersection, exposing them to more conflicts, or crossing at the closed location, with no clear path or signal indication as to when to cross.
- Provide marked crosswalks at signalized intersections.
- Place crosswalks as close as possible to the desire line of pedestrians, which is generally in line with the approaching sidewalks.
- Provide as short as possible a crossing distance to reduce the time that pedestrians are exposed to motor vehicles; this is usually as close as possible to right angles across the roadway, except for skewed intersections.
- Ensure that there are adequate sight lines between pedestrians and motorists. This typically means that the crosswalks should not be placed too far back from the intersection.
- When a raised median is present, extend the nose of the median past the crosswalk with a cut-through for pedestrians.
- Provide one ramp per crosswalk (two per corner for standard intersections with no closed crosswalks). Ramps must be entirely contained within a crosswalk (the crosswalk can be flared to capture a ramp that cannot be easily relocated). Align the ramp run with the crosswalk when possible, as ramps that are angled away from the crosswalk may lead some users into the intersection. At intersections where roads are skewed or where larger radii are necessary for trucks, it can be difficult to determine the best location for crosswalks and sidewalk ramps. In these situations, it is important to balance the recommended practices above. Tighter curb radii make implementing these recommendations easier.

Curb Ramps



*Curb ramp components, and alternate ramp slopes
(Credit: Michele Weisbart)*

Proper curb ramp design is essential to enable pedestrians using assistive mobility devices (e.g., scooters, walkers, and crutches) to transition between the street and the sidewalk. These design guidelines provide a basic overview of curb ramp design. The ADA requires installation of curb ramps in new sidewalks and whenever an alteration is made to an existing sidewalk or street. Roadway resurfacing is considered an alteration and triggers the requirement for curb ramp installations or retrofits to current standards. Curb ramps are typically installed at intersections, mid-block crossings (including trail connections), accessible on-street parking, and passenger loading zones and bus stops.

The following define the curb ramp components along with minimum dimensions:

- **Landing** – the level area at the top of a curb ramp facing the ramp path. Landings allow wheelchairs to enter and exit a curb ramp, as well as travel along the sidewalk without tipping or tilting. This landing must be the width of the ramp and measure at least 4 feet by 4 feet. There should also be a level (not exceeding a 2 percent grade) 4 foot by 4 foot bottom landing of clear space outside of vehicle travel lanes.
- **Approach** – the portion of the sidewalk on either side of the landing. Approaches provide space for wheelchairs to prepare to enter landings.
- **Flare** – the transition between the curb and sidewalk. Flares provide a sloped transition (10 percent maximum slope) between the sidewalk and curb ramp to help prevent pedestrians from tripping over an abrupt change in level. Flares can be replaced with curb where the furniture zone is landscaped.
- **Ramp** – the sloped transition between the sidewalk and street where the grade is constant and cross slope at a minimum. Curb ramps are the main pathway between the sidewalk and street.
- **Gutter** – the trough that runs between the curb or curb ramp and the street. The slope parallel to the curb should not exceed 2 percent at the curb ramp.
- **Detectable Warning** – surface with distinct raised areas to alert pedestrians with visual impairments of the sidewalk-to-street transition.

There are several different types of curb ramps. Selection should be based on local conditions. The most common types are diagonal, perpendicular, parallel, and blended transition.

Diagonal Curb Ramps

Diagonal curb ramps are single curb ramps at the apex of the corner. These have been commonly installed by many jurisdictions to address the requirements of the ADA, but have since been identified as a non-preferred design type as they introduce dangers to wheelchair users. Diagonal curb ramps send wheelchair users and people with strollers or carts toward the middle of the intersection and make the trip across longer.

Perpendicular Curb Ramps

Perpendicular curb ramps are placed at a 90-degree angle to the curb. They must include a level landing at the top to allow wheelchair users to turn 90 degrees to access the ramp, or to bypass the ramp if they are proceeding straight. Perpendicular ramps work best where there is a wide sidewalk, curb extension, or planter strip. Perpendicular curb ramps provide a direct, short trip across the intersection.

Parallel Curb Ramps



*Parallel curb ramp
(Credit: Michele Weisbart)*

Parallel curb ramps are Friendly parallel to the street; the sidewalk itself ramps down. They are used on narrow sidewalks where there isn't enough room to install perpendicular ramps. Parallel curb ramps require pedestrians who are continuing along the sidewalk to ramp down and up. Where space exists in a planting strip, parallel curb ramps can be designed in combination with perpendicular ramps to reduce the ramping for through pedestrians. Careful attention must be paid to the construction of the bottom landing to limit accumulation of water and/or debris.

Curb Ramp Placement

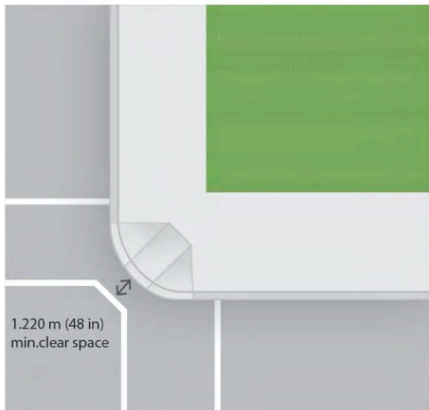
One ramp should be provided for each crosswalk, which usually translates to 2 per corner. This maximizes access by placing ramps in line with the sidewalk and crosswalk, and by reducing the distance required to cross the street, compared with a single ramp on the apex.

A single ramp at the apex requires users to take a longer, more circuitous travel path to the other side and causes users to travel towards the center of the intersection where they may be in danger of getting hit by turning cars; being in the intersection longer exposes the user to greater risk of being hit by vehicles. A single ramp at the apex should be avoided in new construction and may be used only for alterations where a design exception is granted because of existing utilities and other significant barriers. In all cases, reducing the curb radius makes ramp placement easier.



Blended Transitions

Blended transitions are situations where either the entire sidewalk has been brought down to the street or crosswalk level, or the street has been brought up to the sidewalk level. They work well on large radius corners where it is difficult to line up the crosswalks with the curb ramps, but have drawbacks. Children, persons with cognitive impairments, and guide dogs may not distinguish the street edge. Turning vehicles may also encroach onto the sidewalk. For these reasons, bollards, planting boxes, or other intermittent barriers should be installed to prevent cars from traveling on the sidewalk. Detectable warnings should also be placed at the edge of the sidewalk to alert pedestrians with visual impairments of the transition to the street. Municipalities should follow the standards and guidelines for curb ramps provided in Table 6.1.



Detectable Warnings

Because a curb ramp removes the curb that visually impaired persons use to identify the location of a street, a detectable warning surface must be placed at the back of the curb. This detectable strip should be as wide as the ramp and a minimum of 24 inches deep. One corner should be located at the back of the curb and the other corner may be up to 5 feet from the back of the curb. These strips are most effective when adjacent to smooth pavement so the difference is easily detected. Color contrast is needed so partially sighted people can see them.

One ramp per crosswalk vs. single ramp at the apex

(Credit: Michele Weisbart)

Detectable strips should be used at: the edge of depressed corners; The border of raised crosswalks and intersections; the base of curb ramps; the border of medians; the edge of transit platforms and where railroad tracks cross the sidewalk.



Detectable Warning Strip

(Credit: Peter Lagerway)

Uncontrolled Intersections & Mid-block Crosswalks

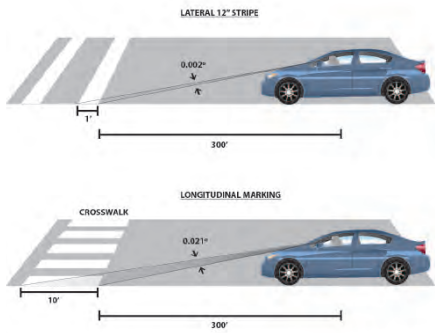


Intersections without traffic signals or STOP signs are considered uncontrolled intersections. The decision to mark a crosswalk at an uncontrolled location should be guided by an engineering study. Factors considered in the study should include vehicular volumes and speeds, roadway width and number of lanes, stopping sight distance and triangles, distance to the next controlled crossing, night time visibility, grade, origin-destination of trips, left turning conflicts, and pedestrian volumes. The engineering study should be based on the FHWA study, *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations*. The following list provides some of the key recommendations from the study:

- It is permissible to mark crosswalks on two-lane roadways.
- On multi-lane roadways, marked crosswalks alone are not recommended under the following conditions (the other tools listed in this section can be considered to enhance the crosswalk):
 - ADT > 12,000 w/o median
 - ADT > 15,000 w/ median
 - Speeds greater than 40 mph
- Raised medians can be used to reduce risk.
- Signals or other treatments should be considered where there are many young and/or elderly pedestrians.

Frequency of Marked Crosswalks at Uncontrolled Locations

Marked crosswalks should be spaced so people can cross at preferred locations. If people are routinely crossing streets at non-preferred locations, consideration should be given to installing a new crossing. Pedestrians need crossings with appropriate devices (islands, curb extensions, advanced yield lines, etc.) of multi-lane streets where there are strong desire lines. Along urban streets, a well-designed crossing should be provided at least every 1/8 mile.



Longitudinal crosswalk markings are more visible than lateral crosswalk markings (Credit: Michele Weisbart)



Typical crosswalk markings: Continental, Ladder, Staggered Continental (Credit: Michele Weisbart)



Decorative crosswalk treatments made of distinctive materials can become uneven over time (Credit: Ryan Snyder)

High-Visibility Crosswalks

Because of the low approach angle at which pavement markings are viewed by drivers, the use of longitudinal stripes in addition to or in place of transverse markings can significantly increase the visibility of a crosswalk to oncoming traffic. While research has not shown a direct link between increased crosswalk visibility and increased pedestrian safety, high-visibility crosswalks have been shown to increase motorist yielding and channelization of pedestrians, leading the Federal Highway Administration to conclude that high-visibility pedestrian crosswalks have a positive effect on pedestrian and driver behavior.

- Colored and stamped crosswalks should only be used at controlled locations.
- Staggered longitudinal markings reduce maintenance since they avoid vehicle wheel paths.

Crosswalks and Accessibility

Longitudinal crosswalk markings provide the best visibility for pedestrians with limited vision.

Decorative crosswalk pavement materials should be chosen with care to ensure that smooth surface conditions and high contrast with surrounding pavement are provided. Textured materials within the crosswalk are not recommended. Without reflective materials, these treatments are not visible to drivers at night. Decorative pavement materials often deteriorate over time and become a maintenance problem while creating uneven pavement. The use of color or material to delineate the crosswalks as a replacement of retro-reflective pavement marking should not be used, except in slow speed districts where intersecting streets are designed for speeds of 20 mph or less.

Refuge Islands/Medians



*Staggered median crossing
(Credit: Marcel Schmaedick)*

Refuge islands and medians are the most important, safest, and most adaptable engineering tool for improving street crossings. Note on terminology: a median is a continuous raised area separating opposite flows of traffic. A refuge island is shorter and located just where a pedestrian crossing is needed. Raised medians and refuge islands are commonly used between intersections when blocks are long (500 feet or more in downtowns) and in the following situations:

- Speeds are higher than desired
- Streets are wide
- Traffic volumes are high
- Sight distances are poor

Refuge islands have nearly universal applications and should be placed where there is a need for people to cross the street. They are also used to slow traffic.

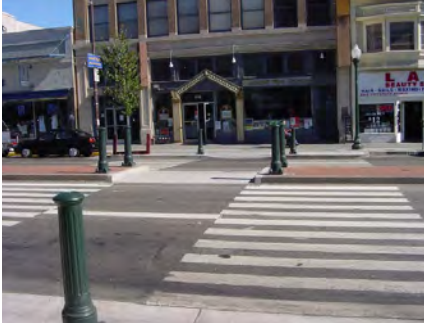
Reasons for Efficacy

Their use changes a complex task, crossing a wide street with traffic coming from two opposing directions all at once, into two simpler and smaller tasks. With their use, conflicts occur in only one direction at a time, and exposure time can be reduced from more than 20 seconds to just a few seconds.

On streets with traffic speeds higher than 30 mph, it may be unsafe to cross without a median island. At 30 mph, motorists travel 44 feet each second, placing them 880 feet out when a pedestrian starts crossing an 80-foot wide multi-lane road. In this situation, this pedestrian may still be in the last travel lane when the car arrives there; that car was not within view at the time he or she started crossing. With an island on multi-lane roadways, people would cross two or three lanes at a time instead of four or six. Having to wait for a gap in only one direction of travel at a time significantly reduces the wait time to cross. Medians and crossing islands have been shown to reduce crashes by 40 percent (Federal Highway Administration, Designing for Pedestrian Safety course).



Medians and refuge islands allow pedestrians to complete the crossing in two stages (Credit: Michele Weisbart)



*Refuge islands: Berkeley, CA
(Credit: Ryan Snyder)*

As a general rule, refuge islands are preferable to signal-controlled crossings due to their lower installation and maintenance cost, reduced waiting times, and their safety benefits. Refuge islands are also used with road diets, taking four-lane undivided, high-speed roads down to better performing three-lane roadways (two travel lanes and a center turn lane); portions of the center turn lane can be dedicated to refuge islands. Refuge islands can also be used with signals.

Angled pedestrian crossings through pedestrian refuges (as shown in the adjacent photo) force pedestrians to look for oncoming vehicles.

Where to Place Refuge Islands

Refuge islands are often used for trails, high pedestrian flow zones, transit stations, schools, work centers, and shopping districts.

Design Detail

Refuge islands, like most traffic calming features, perform best with both tall trees and low ground cover. This greatly increases their visibility, reduces surprise, and lowers the need for a plethora of signs. When curves or hill crests complicate crossing locations, median islands are often extended over a crest or around a curve to where motorists have a clear (six second or longer) sight line of the downstream change in conditions. Lighting of median islands is essential. The suggested minimum width of a crossing island is 6 feet. When used on higher speed roads, and where there is space available, inserting a 45-degree bend to the right helps orient pedestrians to the risk they encounter from motorists during the second half of their crossing.



Multiple tools can be employed to improve uncontrolled crossings (Credit: Dan Burden)

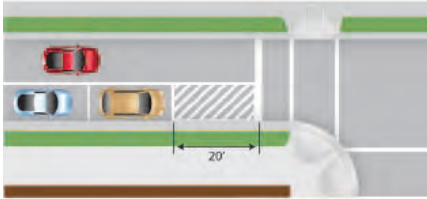
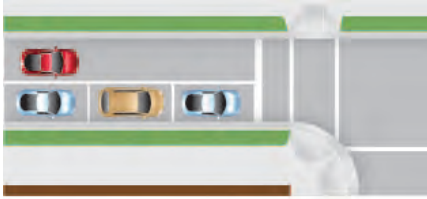
Raised Crosswalks

Raised crosswalks slow traffic and put pedestrians in a more visible position. They are trapezoidal in shape on both sides and have a flat top where the pedestrians cross. The level crosswalk area must be paved with smooth materials; any texture or special pavements used for aesthetics should be placed on the beveled slopes, where they will be seen by approaching motorists. They are most appropriate in areas with significant pedestrian traffic and where motor vehicle traffic should move slowly, such as near schools, on college campuses, in Main Street retail environments, and in other similar places. They are especially effective near elementary schools where they raise small children by a few inches and make them more visible.



*Raised crosswalk: University of North Carolina Campus, Chapel Hill, NC
(Credit: Ryan Snyder)*

Curb Extensions



Curb extensions improve sight distance between pedestrians and motorists, possibly allowing additional on-street parking
(Credit: Michele Weisbart)

Curb extensions extend the sidewalk or curb line out into the parking lane, which reduces the effective street width. Curb extensions significantly improve pedestrian crossings by reducing the pedestrian crossing distance, visually and physically narrowing the roadway, improving the ability of pedestrians and motorists to see each other, and reducing the time that pedestrians are in the street. Reducing street widths improves signal timing since pedestrians need less time to cross.

Motorists typically travel more slowly at intersections or mid-block locations with curb extensions, as the restricted street width sends a visual cue to slow down. Turning speeds are lower at intersections with curb extensions (curb radii should be as tight as is practicable). Curb extensions also prevent motorists from parking too close to the intersection.

Curb extensions also provide additional space for two curb ramps and for level sidewalks where existing space is limited, increase the pedestrian waiting space, and provide additional space for pedestrian push button poles, street furnishings, plantings, bike parking and other amenities. A benefit for drivers is that extensions allow for better placement of signs (e.g., stop signs and signals).

Curb extensions are generally only appropriate where there is an on-street parking lane. Where street width permits, a gently tapered curb extension can reduce crossing distance at an intersection along streets without on-street parking, without creating a hazard. Curb extensions must not extend into travel lanes or bicycle lanes.



Curb extensions
(Credit: Michele Weisbart)

Signs



Signs can provide important information to improve road safety by letting people know what to expect, so they can react and behave appropriately. Sign use and placement should be done judiciously, as overuse breeds noncompliance and disrespect. Too many signs create visual clutter.

Regulatory signs, such as STOP, YIELD, or turn restrictions, require driver actions and can be enforced. Warning signs provide information, especially to motorists and pedestrians unfamiliar with an area.

Advance pedestrian warning signs should be used where pedestrian crossings may not be expected by motorists, especially if there are many motorists who are unfamiliar with the area. The fluorescent yellow/green color is designated specifically for pedestrian, bicycle, and school warning signs (Section 2A.10 of the 2009 MUTCD) and should be used for all new and replacement installations. This bright color attracts the attention of drivers because it is unique.

Sign R1-5 should be used in conjunction with advance yield lines, as described below. Sign R1-6 may be used on median islands, where they will be more visible to motorists than signs placed on the side of the street, especially where there is on-street parking. Since California is a “yield” state, cities should use R1-5, R1-5a, and R1-6 signs.

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.

All sign installations need to comply with the provisions of the MUTCD.

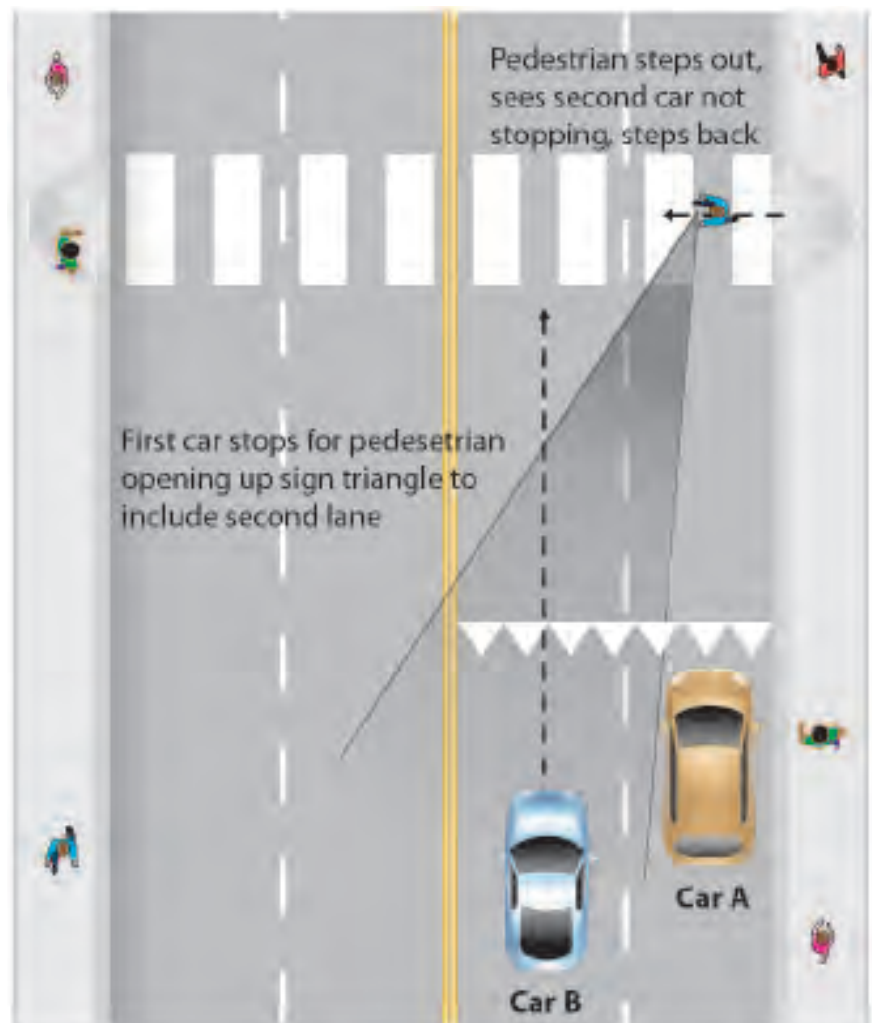
Advanced Yield/Stop Lines



*Advanced yield markings
(Credit: Sky Yim)*

Stop lines are solid white lines 12 to 24 inches wide, extending across all approach lanes to indicate where vehicles must stop in compliance with a stop sign or signal. Advance stop lines reduce vehicle encroachment into the crosswalk and improve drivers' view of pedestrians. At signalized intersections a stop line is typically set back between 4 and 6 feet.

At uncontrolled crossings of multi-lane roads, advance yield lines can be an effective tool for preventing multiple threat vehicle and pedestrian collisions. Section 3B.16 of the MUTCD specifies placing advanced yield markings 20 to 50 feet in advance of crosswalks, depending upon location-specific variables such as vehicle speeds, traffic control, street width, on-street parking, potential for visual confusion, nearby land uses with vulnerable populations, and demand for queuing space. Thirty feet is the preferred setback for effectiveness at many locations. This setback allows a pedestrian to see if a car in the second (or third) lane is stopping after a driver in the first lane has stopped.



*Advanced yield markings
(Credit: Michele Weisbart)*

Lighting



Proper placement of crosswalk illumination (Credit: Michele Weisbart)

Lighting is important to include at all pedestrian crossing locations for the comfort and safety of the road users. Lighting should be present at all marked crossing locations. Lighting provides cues to drivers to expect pedestrians earlier.

FHWA HT-08-053, *The Information Report on Lighting Design for Mid-block Crosswalks*, found that a vertical illumination of 20 lux in front of the crosswalk, measured at a height of 5 feet from the road surface, provided adequate detection distances in most circumstances. Although the research was constrained to mid-block placements of crosswalks, the report includes a brief discussion of considerations in lighting crosswalks co-located with intersections. The same principle applies at intersections. Illumination just in front of crosswalks creates optimal visibility of pedestrians.

Other good guidance on crosswalk lighting levels comes from the Illuminating Engineering Society of North America (IESNA) intersection guidance to illuminate pedestrians in the crosswalk to vehicles (see the adjacent image). Crosswalk lighting should provide color contrast from standard roadway lighting.

Other good guidance on crosswalk lighting levels comes from the Illuminating Engineering Society of North America (IESNA) intersection guidance to illuminate pedestrians in the crosswalk to vehicles (see the adjacent image). Crosswalk lighting should provide color contrast from standard roadway lighting.

Recommended Illumination by Street Type

Functional Classification	Average Maintained Illumination at Pavement by Pedestrian Area Classification [FC]		
	High	Medium	Low
Major / Major (boulevard)	3.4 fc	2.6 fc	1.8 fc
Major / Collector (boulevard/avenue)	2.9 fc	2.2 fc	1.5 fc
Major / Local (avenue)	2.6 fc	2.0 fc	1.3 fc
Collector / Collector (avenue)	2.4 fc	1.8 fc	1.2 fc
Collector / Local (street)	2.1 fc	1.6 fc	1.0 fc
Local / Local (street)	1.8 fc	1.4 fc	0.8 fc

FC stands for “foot candle” and is defined as the amount of illuminance on a 1 square foot surface of which there is uniformly distributed flux of one lumen. ANSI-IESNA RP-8-00, “Roadway Lighting,” P. 15

Pedestrian Hybrid Beacon

A pedestrian hybrid beacon is used to warn and control traffic at an unsignalized location so as to help pedestrians cross a street or highway at a marked crosswalk.

A pedestrian hybrid beacon can be used at a location that does not meet traffic signal warrants or at a location that meets traffic signal warrants but a decision has been made to not install a traffic control signal. A minimum number of 20 pedestrians per hour is needed to warrant installation. This is substantially less than the 93 minimum needed for a signal installation.

If beacons are used, they should be placed in conjunction with signs, crosswalks, and advanced yield lines to warn and control traffic at locations where pedestrians enter or cross a street or highway. A pedestrian hybrid beacon should only be installed at a marked crosswalk.

Installations should be done according to the MUTCD Chapter 4F, “Pedestrian Hybrid Beacons.”



Rectangular rapid-flash beacon (Credit: SPOT Devices)

Signals

Signalized street crossings require special consideration of people with disabilities. The following text provides guidance to do that.



Crossing Times

In planning for people with disabilities, slower speeds must be considered. This is critical in setting the timing of the walk phase of signalized intersections. The Manual on Uniform Traffic Control Devices (MUTCD) requires that transportation agencies use an assumed walking speed of 3.5 feet/second for signal timing. In situations where a large number of older adults or persons with disabilities cross, this may be inadequate to meet their needs. Some cities instead use 2.8 feet/second.



Pedestrian-Activated Push Buttons

Pedestrian-activated traffic controls require pedestrians to push a button to activate a walk signal. Where pedestrian-activated traffic controls exist, they should be located as close as possible to curb ramps without reducing the width of the path. The buttons should be at a level that is easily reached by people in wheelchairs near the top of the ramp. The U.S. Access Board guidelines recommend buttons raised above or flush with their housing and large enough (a minimum of 2 inches) for people with visual impairments to see them. The buttons should also be easy to push.

Accessible Pedestrian Signals (APS)

Wayfinding for pedestrians with visual impairments is significantly improved with the use of APS at signalized intersections. In fact, APS are the most commonly requested accommodation under Section 504 of the Rehabilitation Act of 1973. APS communicate information about pedestrian timing in non-visual formats such as audible tones, verbal messages, and/or vibrating surfaces. Verbal messages provide the most informative guidance. These devices should be installed close to the departure location and on the side away from the center of the intersection. Since they are typically only audible 6 to 12 feet from the push button, 10 feet should separate two APS devices on a corner. If two accessible pedestrian pushbuttons are placed less than 10 feet apart or on the same pole, each accessible pedestrian pushbutton shall be provided with a pushbutton locator tone, a tactile arrow, a speech walk message for the WALKING PERSON (symbolizing WALK) indication, and a speech pushbutton information message. Volumes of the walk indication and push button locator tone shall automatically adjust in response to ambient sound.



*Pedestrian push button placement
(Credit: Michele Weisbart)*

ROADWAY ELEMENTS

Living street design treats streets as part of the public realm. The street portion of the public realm is shaped by the features and cross section elements used in creating the street. Attention to what features are included, where they are placed, and how the cross section elements are assembled is necessary.

Travel Lanes



Travel lane widths should be provided based on the context and desired speed for the area that the street is located in. The table below shows lane widths and the associated speeds that are appropriate. In low speed urban environments, lane widths are typically measured to the curb face instead of the edge of the gutter pan. Consequently, when curb sections with gutter pans are used, the vehicle, bike, and parking lane all include the width of the gutter pan.

In order for drivers to understand how fast they should drive, lane widths have to create some level of driver discomfort when driving too fast. The presence of on-street parking is important in achieving the speeds shown in the table below. When designated bike lanes or multi-lane configurations are used, there is more room for large vehicles, such as buses, to operate in, but car drivers will feel more comfortable driving faster than is desired.

Travel Lane Widths and Associated Design Speeds

Movement Type	Design Speed	Travel Lane Width
Yield	Less than 20 mph	N/A
Slow	20-25 mph	9** - 10 feet
Low	30-35 mph	10 - 11 *** feet

*Yield streets are typically residential two-way streets with parking on one or both sides. When the street is parked on both sides, the remaining space between parked vehicles (12 feet minimum) is adequate for one vehicle to pass through. Minimum width for a yield street with parking on both sides should be 26 feet curb face to curb face. Minimum width for a yield street with parking on one side should be 20 feet curb face to curb face, which allows for two 10-foot lanes when the street is not parked.

**9' requires a design exemption.

***Generally, 10-foot lanes are preferred. Where heavy bus or truck traffic exists, 11-foot lanes may be considered.

Alleys can be designed as one-way or two-way. Right-of-way width should be a minimum of 20 feet with no permanent structures located within the right-of-way that would interfere with vehicle access to garages or parking spaces, access for trash collection, and other operational needs. Pavement width should be a minimum of 12 feet. Coordination with local municipalities on operational requirements is essential to ensure that trash collection and fire protection services can be completed.

Turn Lanes

The need for turn lanes for vehicle mobility should be balanced with the need to manage vehicle speeds and the potential impact on the border width such as sidewalk width. Turn lanes tend to allow higher speeds to occur through intersections, since turning vehicles can move over to the turn lane, allowing the through vehicles to maintain their speed.



Center-turn lane (Credit: URS)

Center-turn lanes are effective where multiple curb cuts creates traffic delay as vehicles wait to turn left. This delay is usually pronounced at peak hour traffic flow. A center-turn lane, where roadway width allows, provides space for left turning vehicles without delaying through traffic. These lanes can be used in conjunction with medians and narrow travel lanes to create a traffic calming effect.

Left-turn lanes are considered to be acceptable in an urban environment since there are negative impacts to roadway capacity when left turns block the through movement of vehicles. Sometimes just a left-turn pocket is sufficient, just long enough for one or two cars to wait out of traffic. The installation of a left-turn lane can be beneficial when used to perform a road diet such as reducing a four lane section to three lanes with the center lane providing for turning movements.

In urban places, normally no more than one left-turn lane should be provided. While right turns from through lanes may delay through movements, they also create a reduction in speed due to the slowing of turning vehicles. The installation of right-turn lanes increases the crossing distance for pedestrians and the speed of vehicles; therefore, exclusive right turn lanes should rarely be used except at “T” intersections. When used, they should be mitigated with raised channelization islands.

On-Street Parking



On-Street Parking

On street parking can be important in the urban environment for the success of the retail businesses that line the street and to provide a buffer for pedestrians and help calm traffic speeds. On-street parking occupies about half the surface area per car compared to off-street, which requires driveways and aisles for access and maneuvering. However, cities should manage demand for on-street parking by charging market-rate prices. Free or underpriced parking encourages people to drive instead of taking transit, biking, or walking. Parking expert Donald Shoup recommends setting variable parking prices to target a 15 percent vacancy rate for curbside parking. In addition to encouraging people to curtail driving, it also creates turnover that benefits retailers by making convenient parking available for short shopping trips.

Where angle parking is proposed for on-street parking, designers should consider the use of reverse-in angle (or front out) parking in lieu of front-in angled parking. Motorists pulling out of reverse-in angled parking can better see the active street they are entering. This is especially important to bicyclists. Moreover, people exiting cars do so on the curb side and aren't likely to step into an active travel lane.

Another tool for on-street parking is the park assist lane. Often when on-street parking is provided on busy roads, drivers find it difficult to enter and leave their parked vehicle. Where space is available, consideration should be given to adding a park assist lane between the parking lane and travel way to provide 3 feet of space so car doors can be opened and vehicles can enter or depart with a higher degree of safety and less delay. Bike lanes can serve this function as well. Parking assist lanes also narrow the feel of the travel lane and slow traffic.

The table below details recommended parking lane widths for slow and low movement types.

Movement Type	Design Speed	Parking Lane Width
Slow	20-25 mph	Angle: 16.5' (60°); 15' (45°)
Slow	20-25 mph	Parallel: 7 feet
Low	30-35 mph	Parallel: 7-8 feet

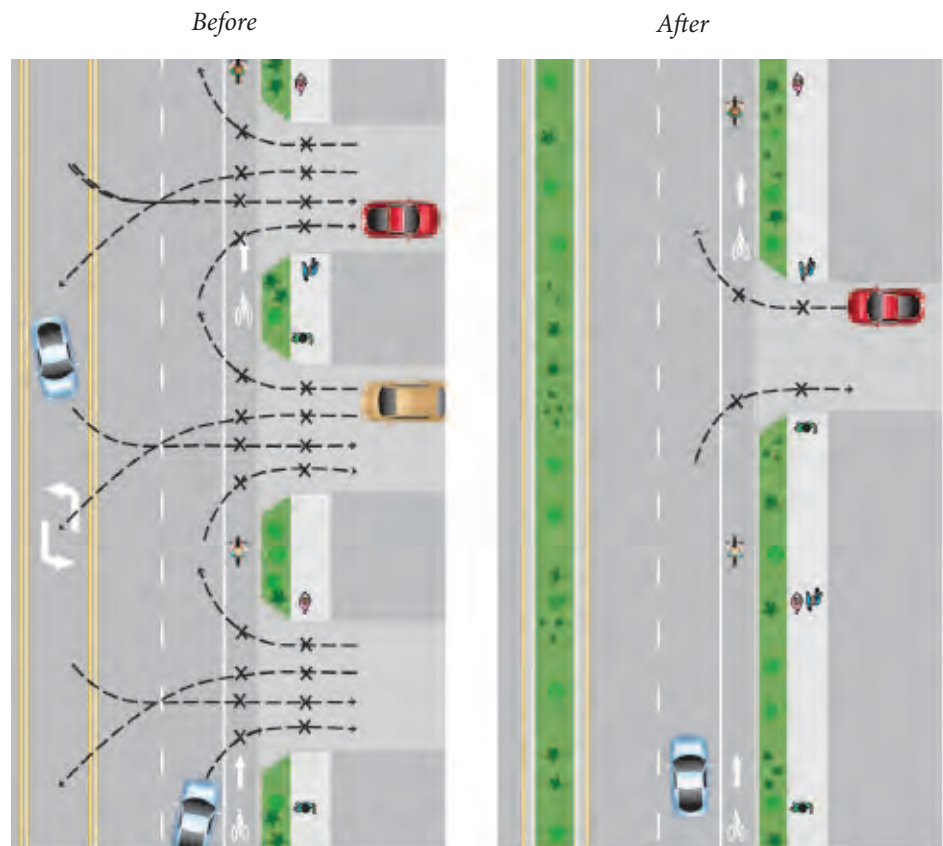
Parking Lane Widths

Access Management

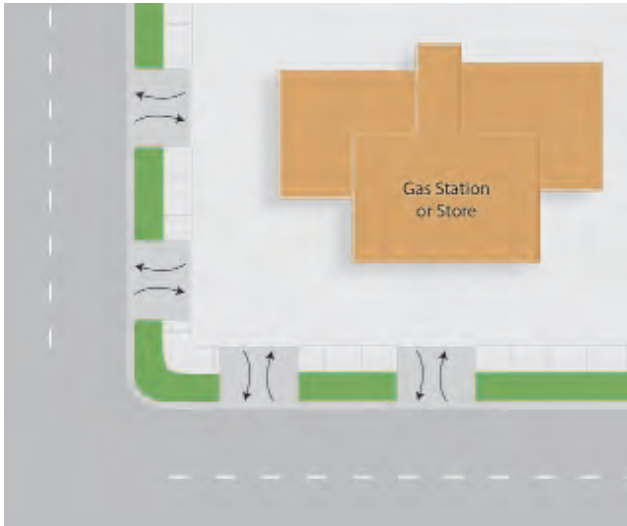
A major challenge in street design is balancing the number of access points to a street. There are many benefits of well-connected street networks. On the other hand, most conflicts between users occur at intersections and driveways. The presence of many driveways in addition to the necessary intersections creates many conflicts between vehicles entering or leaving a street and bicyclists and pedestrians riding or walking along the street. When possible, new driveways should be minimized and old driveways should be eliminated or consolidated, and raised medians should be placed to limit left turns into and out of driveways.

Access management through limiting driveways and providing raised medians has many benefits:

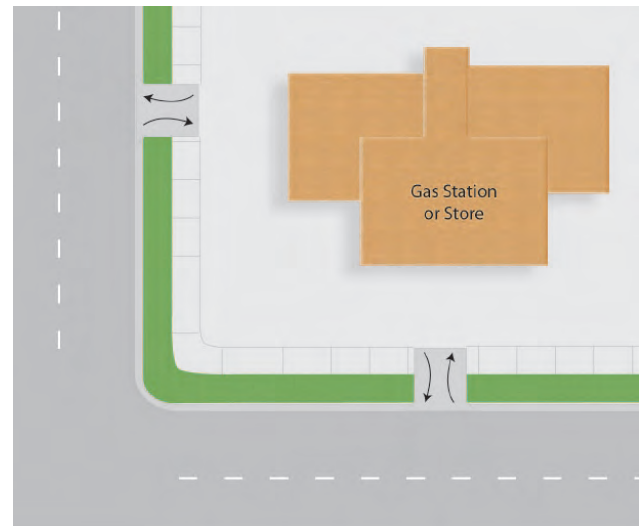
- The number of conflict points is reduced, especially by replacing center-turn lanes with raised medians since left turns by motorists account for a high number of crashes with bicyclists and pedestrians.
- Pedestrian crossing opportunities are enhanced with a raised median.



*Adding medians and consolidating driveways to manage access
(Credit: Michele Weisbart)*



*Corner with many wide driveways
(Credit: Michele Weisbart)*



*Reconstructed corner with fewer, narrower driveways
(Credit: Michele Weisbart)*

- Universal access for pedestrians is easier, since the sidewalk is less frequently interrupted by driveway slopes.
- Fewer driveways result in more space available for higher and better uses.
- Improved traffic flow may reduce the need for road widening, allowing part of the right-of-way to be recaptured for other users.

Possible Negatives of Access Management

The following possible negative effects of management should be considered and addressed:

- Streamlining a street may increase motor vehicle speeds and volumes, which can be detrimental to other users.
- Reduced access to businesses may require out-of-direction travel for all users, including walkers and bicyclists.
- Concrete barriers and overly-landscaped medians act as barriers to pedestrian crossings. Medians should be designed with no more than normal curb height and with landscaping that allows pedestrians to see to the other side.
- Adjacent land uses can experience decreased access. This can impact businesses as well as residents. Careful planning of access management considers this.

Medians

Medians used on urban streets provide access management by limiting left turn movements into and out of abutting development to select locations where a separate left turn lane or pocket can be provided. The reduced number of conflicts and conflict points decreases vehicle crashes, provides pedestrians with a refuge as they cross the road, and provides space for landscaping, lighting, and utilities. These medians are usually raised and curbed. Landscaped medians enhance the street or help to create a gateway entrance into a community.

Medians can be used to create tree canopies over travel lanes, contributing to a sense of enclosure. As shown in the table below, medians vary in width. Recommended widths depend on available right-of-way and function. Because medians require a wider right-of-way, the designer must weigh the benefits of a median with the issues of pedestrian crossing: distance, speed, context, and available roadside width.



Well-designed street medians bring multiple benefits (Credit: Dan Burden)

Median Type	Minimum Width	Recommended Width
Median for access control	4 feet	6 feet
Median for pedestrian refuge	6 feet	8 feet
Median for trees and lighting	6 feet [1]	10 feet [2]
Median for single left-turn lane	10 feet [3]	10 feet [2]
Median for single left-turn lane and pedestrian refuge	16 feet [4]	16 feet

Median Types and Widths

Table Notes:

[1] Six feet measured curb face to curb face is generally considered the minimum width for proper growth of small caliper trees (less than 4 inches).

[2] Wider medians provide room for larger caliper trees and more extensive landscaping.

[3] A 10-foot lane provides for a turn lane without a concrete traffic separator.

[4] Includes a 10-foot turn lane and a 6-foot pedestrian refuge.

INTERSECTIONS

Most conflicts between roadway users occur at intersections, where travelers cross each other's path. Good intersection design indicates to those approaching the intersection what they must do and who has to yield. Exceptions to this include places where speeds are low (typically less than 18 mph) or where a shared space design ("naked streets") causes users to approach intersections with caution. Conflicts for pedestrians and bicyclists are exacerbated due to their greater vulnerability, lesser size, and reduced visibility to other users.

The benefits and constraints of intersection features are examined and the appropriate use and design of each feature are described below.

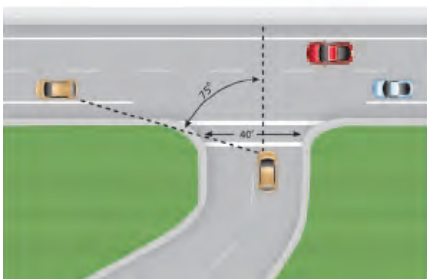
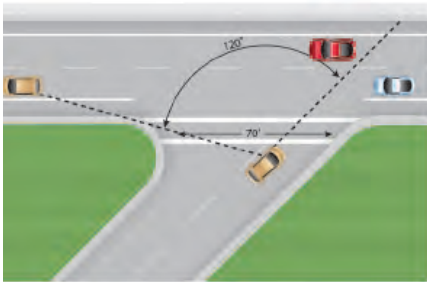
ESSENTIAL PRINCIPLES OF INTERSECTION DESIGN

The following principles apply to all users of intersections:

- Good intersection designs are compact.
- Unusual conflicts should be avoided.
- Simple right-angle intersections are best for all users since many intersection problems are worsened at skewed and multi-legged intersections.
- Free-flowing movements should be avoided.
- Access management practices should be used to remove additional vehicular conflict points near the intersection.
- Signal timing should consider the safety and convenience of all users and should not hinder bicycle or foot traffic with overly long waits or insufficient crossing times.

Intersection geometry is a critical element of intersection design, regardless of the type of traffic control used. Geometry sets the basis for how all users traverse intersections and interact with each other. The principles of intersection geometry apply to both street intersections and freeway on- and off-ramps.

INTERSECTION GEOMETRY



Realigning the skewed intersection in the graphic on the top to the right-angle connection in the graphic on the bottom results in less exposure distance and better visibility for all users (Credit: Michele Weisbart)

Intersection Skew

Skewed intersections are generally undesirable and introduce the following complications for all users:

- The travel distance across the intersection is greater, which increases exposure to conflicts and lengthens signal phases for pedestrians and vehicles.
- Skews require users to crane their necks to see other approaching users, making it less likely that some users will be seen.
- Obtuse angles encourage speeding.

To alleviate the problems with skewed intersections, several options are available:

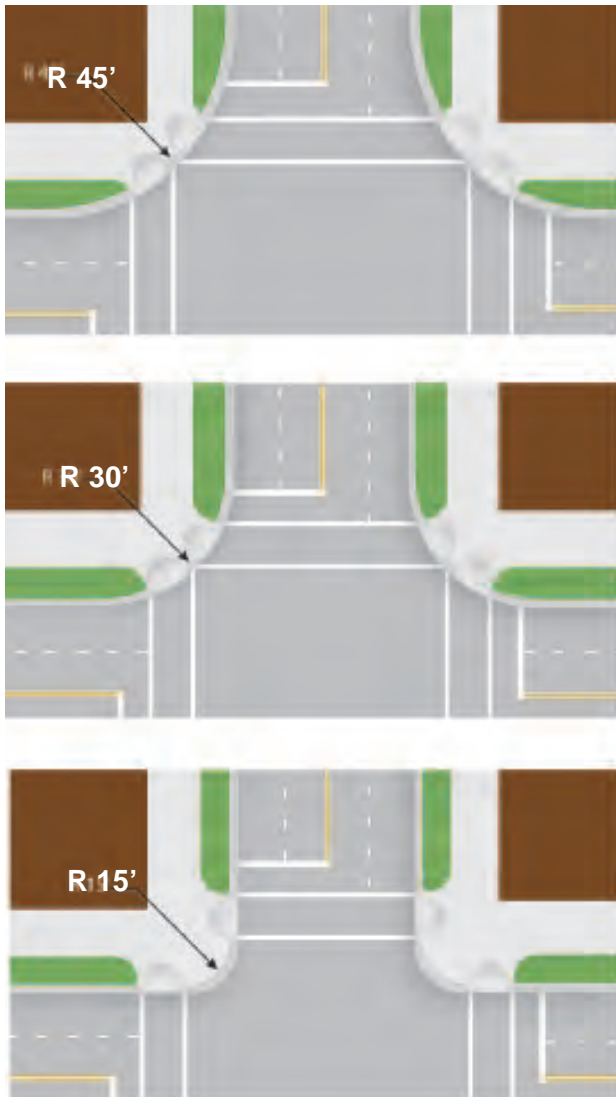
- Every reasonable effort should be made to design or redesign the intersection closer to a right angle.
- Pedestrian refuges should be provided if the crossing distance exceeds approximately 40 feet.
- General use travel lanes and bike lanes may be striped with dashes to guide bicyclists and motorists through a long undefined area.

Multi-leg intersections (more than two approaching roadways) are generally undesirable and introduce the following complications for all users:

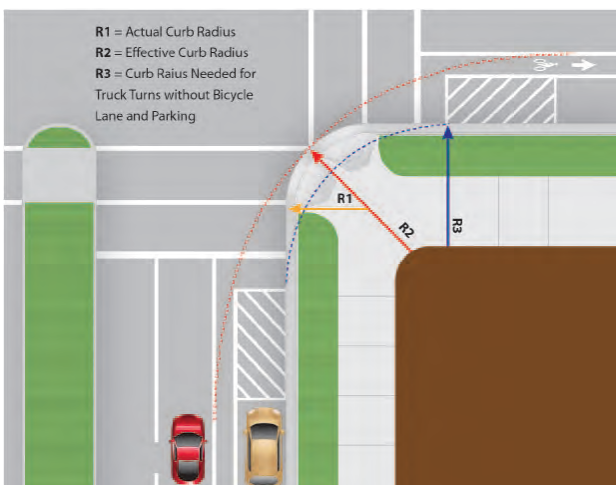
- Multiple conflict points are added as users arrive from several directions.
- Users may have difficulty assessing all approaches to identify all possible conflicts.
- At least one leg will be skewed.
- Users must cross more lanes of traffic and the total travel distance across the intersection is increased.

To alleviate the problems with multi-leg intersections, several options are available:

- Every reasonable effort should be made to design the intersection so there are no more than four legs. This is accomplished by removing one or more legs from the major intersection and creating a minor intersection further up or downstream.
- As an alternative, one or more of the approach roads can be closed to motor vehicle traffic, while still allowing access for pedestrians and bicyclists.
- Roundabouts should be considered.
- Pedestrian refuges should be created if the crossing distance exceeds



Tighter corner radii reduce crossing distance and slow turning traffic (Credit: Michele Weisbart)



The effective corner radius controls turning speeds and the ability of large vehicles to turn (Credit: Michele Weisbart)

Corner Radii

This intersection geometry feature has a significant impact on the comfort and safety of non-motorized users. Small corner radii provide the following benefits:

- Smaller, more pedestrian-scale intersections resulting in shorter crossing distances
- Slower vehicular turning speeds
- Reduced pedestrian crossing distance and crossing time
- Better geometry for installing perpendicular ramps for both crosswalks at each corner
- Simpler, more appropriate crosswalk placement, in line with the approaching sidewalks

When designing corner radii for complete streets, the default design vehicle should be the passenger (P) vehicle. Therefore, the default corner radius is 15 feet. Larger design vehicles should be used only where they are known to regularly make turns at the intersection, and corner radii should be designed based on the larger design vehicle traveling at crawl speed. In addition, designers should consider the effect that bicycle lanes and on-street parking have on the effective radius, increasing the ease with which large vehicles can turn.

Encroachment by large vehicles is acceptable onto multiple receiving lanes. When a design vehicle larger than the passenger (P) vehicle is used, the truck or bus should be allowed to turn into all available receiving lanes. Larger, infrequent vehicles (the “control vehicle”) can be allowed to encroach on multiple departure lanes and partway into opposing traffic lanes.

ROUNABOUTS

Modern roundabouts are potentially the cheapest, safest, and most aesthetic form of traffic control for many intersections. A roundabout is an intersection design with the following characteristics and features.

Users approach the intersection, slow down, stop and/or yield to pedestrians in a crosswalk, and then enter a circulating roadway, yielding to drivers already in the roundabout. The circulating roadway encircles a central island around which vehicles travel counterclockwise. Splitter islands force drivers to turn right, and provide a refuge for pedestrians. Deflection encourages slow traffic speeds, but allows movement by trucks. A landscaped visual obstruction in the central island obscures the driver's view of the road ahead, to discourage users from entering the roundabout at high speeds. Pedestrians are not allowed to access the central island, which should not contain attractions. The central island can vary in shape from a circle to a "square-a-bout" in historic areas, ellipses at odd shaped intersections, dumbbell, or even peanut shapes.



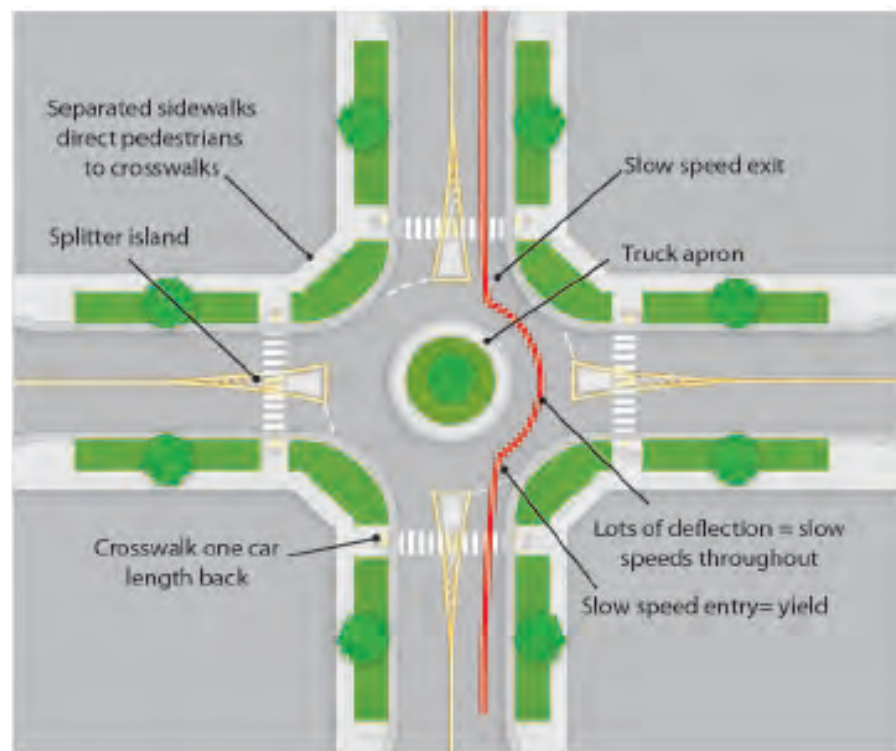
Roundabout: San Diego, CA (Credit: Michael Wallwork)

Each leg of a roundabout has a triangular splitter island that provides a refuge for pedestrians, prevents drivers from turning left (the "wrong-way"), guides drivers through the roundabout by directing them to the edge of the central island, and helps to slow drivers. Roundabouts can range from quite small to quite large, from a central island diameter of about 12 feet for a traffic calming device at a neighborhood intersection to 294 feet to the back of sidewalk on a large multi-lane roundabout.

General Design Elements of Roundabouts

Central Island

The design of the central island is an important element of a roundabout. In conjunction with well-designed approach and departure lanes, the central island controls vehicle speeds through deflection and controls the size of vehicles that can pass through and turn at a roundabout. It provides space for landscaping to beautify an intersection or create a focal point or community enhancement, but it also provides space for the inclusion of a vertical element such as a tree, which is important in providing long range conspicuity of a roundabout.



*Single-lane roundabout
(Credit: Michele Weisbart)*

Splitter Islands

Splitter islands and/or medians on each approach serve several functions. Most importantly, they provide a refuge for pedestrians crossing at the roundabout, breaking the crossing into two smaller crossings. This allows pedestrians to select smaller gaps and cross more quickly. Splitter islands and medians direct vehicles toward the edge of the central island and limit the ability of drivers to make left turns the wrong way into the circulating roadway. Splitter islands should have a minimum width of 6 feet, and preferably 8 feet, from the face-of-curb to the opposite face-of-curb.

Truck Apron

Because central islands must be made large enough to deflect and hence control the speed of passenger vehicles, they can limit the ability of trucks to pass through or turn at a roundabout. To accommodate large vehicles, a truck apron (a paved, load-bearing area) is included around the edge of the central island. The truck apron is often paved with a fairly rough texture, and raised enough to discourage encroachment by smaller high-speed passenger cars. The truck apron should be 3 inches high.

Pedestrian Crossings

Pedestrian crossings are located one car length away from the circulating roadway to shorten the crossing distance, separate vehicle-to-pedestrian conflicts from vehicle-to-vehicle conflicts, and allow pedestrians to cross between waiting vehicles.

Signing and Marking

Signing and marking should be in compliance with the current version of the MUTCD. For detailed design guidance on roundabouts, refer to the NCHRP Report 672, *Roundabouts: An Informational Guide*, Second Edition, 2010. However, care must be taken to not oversign roundabouts by including every sign allowed at roundabouts, except for needed directional signs; most roundabouts are designed so their function and use are self-explanatory.

Accessibility

Multi-lane roundabouts are more complex for pedestrians and bicyclists to use because of the additional lanes, slightly higher speeds, and longer crossing distances. Crossing by some pedestrians with disabilities is a more complex task. As a consequence, the current draft (Proposed Right-of-Way Accessibility Guidelines) PROWAG includes a requirement to install accessible pedestrian signals at all crosswalks across any roundabout approach with two or more lanes in one direction. The PROWAG requirement does not specify the type of signal except that it must be accessible, including a locator tone at the pushbutton, with audible and vibrotactile indications of the pedestrian walk interval.

PART IV - APPENDIX

Additional Resources.....92

ADDITIONAL RESOURCES

Get Your House Right: Architectural Elements to Use and Avoid.

Cusato, Marianne | 2007 | Sterling Publishing

A Field Guide to American Houses.

McAlester, V. & L. | 1984 | Random House

Traditional Construction Patterns: Design and Detail Rules of Thumb.

Mouzon, Stephen A. | 2004 | McGraw-Hill Professional

The Architectural Pattern Book: A Tool for Building Great Neighborhoods.

Urban Design Associates | 2004 | W.W. Norton and Company

The Language of Doors.

Vicente, P. and Connor, T. | 2005 | Artisan