5. INTERSECTIONS

Designing Intersections

This chapter includes the guideline recommendations with the most potential for conflicts and tradeoffs – the ones for designing intersections. In addition to Tables 5.1-5.5, which provide information about most design elements related to the various possible intersection types, this chapter also describes Charlotte's new approach to evaluating the level-of-service (LOS) at intersections for motorists, pedestrians, and bicyclists.



Designing street segments often involves tradeoffs (particularly when retrofitting



streets without ample right-of-way), but designing intersections is even more complicated, for the following reasons:

- There are a large number of possible intersection types, due to the many combinations of street types. Furthermore, each intersection will potentially vary from the "ideal" or "preferred" design, particularly when the requirements of specific land use contexts are also considered.
- Intersections are where the transitions between different street types are most likely to occur. These transitions can

- be problematic, as they present potential conflicts between those elements that might support one street type over another.
- Vehicular traffic delays occur most often at intersections, so engineers typically attempt to reduce travel delays by increasing capacity at intersections. However, intersections are also where pedestrians are expected to cross the street. Conflicts are therefore created, because capacity increases for motorists often lead to lower LOS for other travelers (pedestrians and cyclists). Simply put, each additional turn lane or through lane makes crossing that intersection by foot or bicycle more difficult and is also more likely to directly affect the adjacent land uses through loss of right-of-way. This means that working through design tradeoffs is both more difficult and potentially more important for intersections than for street segments.

• Given the importance of intersections for congestion relief, pedestrian crossings, and commercial interests, these locations are also often where mismatches between transportation and land uses occur.

All of the above issues combine to make intersection design the most likely point of contention between traffic engineers, land use planners, urban designers, the traveling public, and those people who live and work near an intersection. The information contained in this chapter and in Appendices A-C is intended to provide guidance through the myriad tradeoffs associated with intersection design and to support the Urban Street Design Guidelines' objective of providing safer and more convenient travel for all modes.

Level of Service at Signalized Intersections

A consistent definition of the *verb* "intersect" is to "cut or divide by passing through or across". A consistent definition of the *noun* "intersection" is "a place where two or more roads (or streets) meet" or "a junction of roads (or streets)." Common synonyms for the noun "intersection" include crossroads, crossing, or corner. However defined, an intersection is where motorists, pedestrians, and bicyclists come together in their travel, and they compete for the use of the same space or signal time.

A motorist's interest in maintaining a smooth flow through intersections – to not have to wait 1 to 3 minutes for the next green signal phase at a signalized intersection, or to find a safe gap between vehicles traveling on the street perpendicular to his or her approach – collides with the interests of pedestrians and bicyclists to travel across or through the intersection safely. Motor vehicles



At this intersection, the competition between motorists and pedestrians for the same space is particularly pronounced. Vehicles making this right turn and pedestrians wanting to cross in the crosswalk are in obvious conflict, especially since right-turns-on-red are allowed.

traveling through, or making right or left turns will be competing for the same roadway space or signal green time. Pedestrians will be looking for shorter crossing distances and, especially, to not find themselves in conflicts with turning vehicles. Bicyclists will be looking for separation from motor vehicles.

As discussed earlier, intersections are also much more likely than segments to be the places where there are capacity deficiencies. This is why more through or turn lanes are added at intersections. A segment with only two travel lanes in one travel direction may widen to four lanes at an intersection, for example.

There is an ongoing, intense pressure for traffic engineers to add lanes at intersections, so as to reduce delays for motor vehicles traveling during peak travel periods. However, the decisions made about enhancing traffic LOS conditions during peak traffic periods will affect the cross-section of the intersection for all hours of every day and night. This is why, as part of these Guidelines, CDOT is changing the analytic process and the City will be changing the stakeholders' expectations about the physical and operational design of intersections.

To that end, CDOT has devised methodologies for determining LOS for bicycles and pedestrians at signalized intersections. The technical details of these methodologies can be found in Appendix B, and a more detailed description of their application is found in Appendix A.

Appendix A describes the analytic process and multi-modal assumptions that will be used for any evaluation of or construction project for a signalized intersection—anyone involved in such analyses should be familiar with and apply this approach.

The intersection of Randolph and Wendover Roads (right), is an example where capacity increases for motor vehicles have affected pedestrian level-of-service, though the land uses and their orientation to the intersection make the issue less obvious.



The intersection of Sharon and Fairview Roads (above): capacity increases made for motor vehicles have made pedestrian crossings in this multi-use area much more difficult.



The bicycle and pedestrian LOS methodologies, described in Appendix B, are used—in conjunction with existing traffic analysis methods—to evaluate how a signalized intersection performs for all travelers. Traditionally, the concept of LOS has only been applied to motor vehicles and then mostly related to traffic congestion or reduction of motorists' delay. The types of improvements that result from such a single mode approach, however, are not necessarily benign for other travelers or for the City. For that reason, these Guidelines introduce the approach wherein all users' interests are evaluated when making decisions about intersection design.

The Guidelines' multi-modal approach to intersection planning and design includes a "trigger" or threshold for considering an intersection for potential capacity increases. As outlined in the technical table in Appendix A, that threshold value varies according to the street type. Since Main Streets and some

Avenues are intended to be much more pedestrian-oriented than are Boulevards and Parkways, it stands to reason that the threshold required to investigate potential vehicular capacity increases at these intersections should be set higher, to avoid unintended negative impacts on pedestrians, cyclists, and adjacent land uses. Therefore, the threshold volume/capacity (V/C) ratio for motor vehicles is not only higher, but it will also be measured for two hours, rather than for only the peak 60 minute period.

Using a higher threshold doesn't mean that congestion is ignored, only that its influence is tempered to meet other street design objectives. This approach allows careful consideration of the likely impacts of potential improvements on pedestrians, cyclists, and the adjacent land uses, prior to making design decisions based solely on traffic congestion.

Once the threshold for a *given intersection type is met* and an intersection is listed as "saturated", then the intersection will be evaluated as to the types of options that might be implemented and the potential impacts of those options. The pedestrian and bicycle LOS methodologies will be applied to meet the target pedestrian and bicycle LOS for that specific intersection type.

In some cases, meeting the pedestrian and bicycle LOS targets may prove very difficult if vehicular capacity increases are provided. The LOS measures for these modes are primarily determined by the number of lanes that must be crossed on foot or by bike and the physical and operational (signalization) elements included to aid in crossing. Depending on the land use context and other functional aspects of the surrounding street network, it may not be possible to both expand capacity and maintain or enhance other travelers' LOS. Where that occurs, the planning and design

team should thoroughly evaluate the overall objectives for the intersection in relation to the rest of the network and the City's goals for provision of multimodal streets. In many parts of the City, the decision may well be that the capacity improvement cannot or should not occur.

Sight Distance at Corners

Once the decision to make changes at an intersection occurs, the tables found in this chapter are used to decide how, and in which combinations, various design elements should be provided in the design of that intersection. An important design consideration that is not, however, included in Tables 5.1-5.5, is corner sight distance, which impacts the relationship between the street and the buildings adjacent to it.

Sight distance refers to the ability of motorists to see other vehicles or objects in the street without obstructions.

Sight distance is applicable where motorists need to decide whether to stop or whether to enter an intersection.

These Urban Street Design Guidelines have some objectives that will change the way that CDOT's current sight distance recommendations are applied. In general, CDOT's Sight Distance

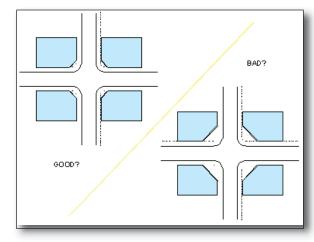


Figure 5.1. Sight Distance Triangles in Urban Locations: Potentially Conflicting Objectives?

Policy will be applied to all intersections, although there are some instances that will call for using the policy with the greatest possible flexibility. For example, in a very urban or pedestrian-oriented context, there may be a conflict between sight triangles (the space available for drivers to see each other as they approach an intersection) and the desire to have buildings situated close to the street or even directly behind the sidewalk (Figure

5.1). Even with the wider sidewalks and amenity zones found in these areas, meeting the requirement of a strictly applied sight triangle for an adjacent intersection may not be possible or desirable. Likewise, the requirements for departure sight triangles along streets (when pulling out of side streets or driveways), if applied strictly, may conflict with the desire to provide bus shelters, street furnishings, or enough street trees of sufficient size to create a canopy.

On the other hand, on streets designed for other contexts, where higher speeds and land uses with deeper setbacks are found, a stricter application of the sight distance recommendations is required. In those cases, the traditional viewpoint of maintaining adequate "room for error" by motorists is necessary for maintaining safety - a worthwhile objective and intended outcome for all streets and intersections defined within these Guidelines.

In summary, corner sight distance must be applied carefully, to avoid unintended and potentially negative consequences. As with many of the recommendations contained within these Guidelines, those designing a street should make an effort to best match the design outcome to the surrounding context.

Traffic Signal Timing

As described earlier in this chapter, designing the physical elements of an intersection to satisfy multiple objectives related to motorists, pedestrians, and cyclists can be challenging. Likewise, there are many tradeoffs to consider when timing traffic signals, because people traveling through one location and using different modes essentially "compete" for green signal time. Specific signal timing recommendations are not included in Tables 5.1 – 5.5, but signal timing is an important and complex component of meeting the multi-modal objectives of these Urban Street Design Guidelines.

Why is signal timing so complex? The following illustrates some of the difficulties of satisfying everyone who is impacted by signal timing at an intersection:

• Not surprisingly, most motorists do not like to be stopped by traffic signals.

Once they do stop, they typically want to move again as soon as possible.

- Traffic signal timing traditionally heavily favors (provides more "green time" to) the higher-volume street over the lower-volume street sometimes creating noticeably higher delays for motorists waiting on the lower-volume street. Motorists on the higher-volume street are less likely to be stopped at any given side street, but motorists on the lower-volume street often feel that their wait is excessive.
- In addition to "fairly" allocating green time between competing motorists, it is also important to provide enough green time for safe pedestrian crossings which can have the unintended consequence of increasing overall cycle lengths at the intersection. However, it is important to provide for pedestrians, particularly in pedestrian-oriented areas, and even where it might be more difficult, such as at very large

or high-traffic-volume intersections, where pedestrians might otherwise have a difficult time traversing the intersection.

- Like motorists, pedestrians also do not like to wait a long time to cross an intersection and, when the wait is perceived as being "too long", are more likely than motorists to cross against the signal.
- Signalized intersections do not function solely as discrete locations – they are increasingly operated as part of a



group of signals and, therefore, signal timing (and "green time" allocation) at any given intersection is typically not considered independent of other, nearby intersections.

Charlotte's signal timing practices are increasingly reflecting a corridor-level, system-oriented approach. This approach also is being refined to reflect our multi-modal objectives. Signal cycle length tradeoff decisions will help meet those objectives, in part through the following assumptions:

- In general, shorter cycle lengths and wait times are desirable, particularly when this can also accommodate pedestrian crossings.
- Signal timing decisions will consider the types of streets that intersect (the intersection "context"), in addition to the nearby (potentially synchronized) intersections that might be affected.

- Signal timing decisions will not always heavily favor the higher-volume streets or flows, although every attempt will be made to maintain satisfactory throughput.
- The objective of minimizing vehicular delay and/or maximizing vehicular throughput is a higher priority for Boulevards and Parkways than for Main Streets or Avenues.

Intersection Design Elements

Tables 5.1 – 5.4 describe the features of non-local intersection types (Main Streets, Avenues, Boulevards, and Parkways). The information in these sections is detailed, but not necessarily prescriptive. The detailed information on dimensions should be used by the design team in conjunction with the design method and tradeoff analyses outlined in Chapter 3 and the LOS guidelines discussed above and described in Appendix A. Note that the plan view diagrams do not show dimensions for these street types, as the focus is on understanding and evaluating the tradeoffs among the various uses and users of the right-of-way.

Table 5.5 describes the design elements for local intersections (Residential, Office/Commercial, and Industrial). The elements and dimensions described are more prescriptive than those for the non-local streets, since these streets are typically provided through the development process.

Some of the design elements described in the following tables represent the "ideal" for which the City is striving, but will require further refinement for an incremental approach to implementation. In many cases, there are specific programs that are responsible for providing such features and it will be necessary to update our approaches to reflect these new Guidelines. These program updates will include evaluating the timing required to meet the design goals for most intersections and developing priorities to ensure practical implementation. Elements that will be subject to such evaluation and prioritization include, for example, enhanced crosswalks, audible pedestrian signals, and bicycle detectors.

5.1 Main Street Intersections

This section describes the features of all (non-local street) intersections that include at least one Main Street approach to the intersection. Main Streets can intersect with all of the other street types, except for Parkways. With the proper application of these Guidelines, Main Street intersections will be located in a pedestrian-oriented context. This is why Main Streets and Parkways should not intersect - because they should exist in mutually exclusive contexts. The design of a Main Street intersection will typically favor the pedestrian orientation of the Main Street leg, whether the intersecting street is a Local Street, an Avenue, or a Boulevard. For example, although Avenues and Boulevards will have higher volumes, more lanes, and higher speeds than do Main Streets, their intersections with Main Streets should be carefully designed to maintain a relatively high pedestrian level-of-service, even with the potential for more through lanes.

General Intent:

- (1) Pedestrian-oriented design and very good pedestrian level of service (LOS) should guide the design decision for <u>all</u> Main Street intersections (see Appendix A for a description of how to balance pedestrian and bicycle LOS with vehicular LOS).
- (2) At Main Street intersections with Avenues and Boulevards, the physical and operational design should particularly provide very good pedestrian LOS if the Main Street extends across the intersecting street (see Appendix B for a description of the pedestrian LOS methodology).
- (3) Some elements will remain constant for all Main Street intersections, such as the use of enhanced pavement markings, countdown signals, not allowing right-turns-on-red, and limiting the use of turn lanes onto and off of Main Streets.

The following table provides guidance in applying design elements to different types of Main Street intersections. The column headings refer to the various possible types of approach legs. The "Main Street Approach" column should be used to assess Main-to-Main intersections, as well as the Main Street approach to any of the other intersection types (Main-to-Avenue and Main-to-Boulevard). Note that the recommendations for Avenues and Boulevards are intended to maintain a relatively high pedestrian LOS at intersections with Main Streets. For a discussion of Main streets intersecting Local Streets, see "Local Street Intersections," Section 5.5.

Main Street Intersections



Main Street Intersections

Diagram reflects possible scenarios and intersection may vary slightly in design. For specific information refer to the guidelines shown on Table 4.1.

Table 5.1 Main Street Intersection Elements

Element:	Main/Main Intersections	Avenue Approach to	Boulevard Approach to	Parkway Approach to Main
	or Main Approach to Oth-	Main/Avenue Intersec-	Main/Boulevard	Street Intersection:
	er Intersection Types:	tion:	Intersection:	
Level of Service (Lo	OS):			
• Pedestrian	LOS A for the entire	LOS B for the entire Main/	LOS B for the entire	Not a valid intersection type.
LOS Objec-	Main/Main intersection.	Ave intersection.	Main/Blvd intersection.	
tive				
Bicycle LOS	Not applicable (see Ap-	LOS B for the entire Main/	LOS B for the entire	Not a valid intersection type.
Objective	pendix A for details).	Ave intersection, using the	Main/Blvd intersection,	
		average LOS value of only	using the average LOS	
		the Avenue approaches	value of only the Blvd ap-	
		(see Appendix A for de-	proaches (see Appendix A	
		tails).	for details).	
Motor	1.0, for two consecutive	1.0, for two consecutive	.95, for two consecutive	Not a valid intersection type.
Vehicle V/C	AM or PM hours, for the	AM or PM hours, for the	AM or PM hours, for the	
Threshold	entire Main/Main inter-	entire Main/Avenue inter-	entire Main/Blvd intersec-	
	section.	section.	tion.	
Median	Atypical, but allowable	Atypical. When provided,	Should be provided, with	Not a valid intersection type.
	under special circum-	should be a minimum	a minimum width of 8'	
	stances (see Section 4.1).	width of 6' (for pedestrian	(for adequate pedestrian	
		refuge) at intersections, 8'	refuge) at intersections.	
		preferred.		

Main Street Intersection Elements (continued) Table 5.1

Element:	Main/Main Intersections or Main Approach to Oth- er Intersection Types:	Avenue Approach to Main/Avenue Intersection:	Boulevard Approach to Main/Boulevard Intersection:	Parkway Approach to Main Street Intersection:
Pedestrian Refuge Island	Atypical, but allowable at signalized intersections, if necessary for traffic calming. Where provided, refuges should be a minimum of 6' wide, measured face-of-curb to face-of-curb.	Consider when there are 4 or more lanes on the approach. To be provided either by extending the median to the crosswalk or by providing a separate 6' minimum, pedestrian refuge (measured face-of-curb to face-of-curb).	Yes, typically created by extending the median through the crosswalk (8' minimum width at intersections with Main Streets, due to high speeds on Blvds).	Not a valid intersection type.
Number of Through Lanes	No more than 1 in each direction.	Typically, 1 to 2 lanes in each direction.	Typically, 2 lanes in each direction.	Not a valid intersection type.
Left-Turn Lane	Allowable only with the 3-lane Main Street cross-section. Typically, the turn lane will be 10' wide.	Will be provided with the 3-lane and the 5-lane cross-sections. Allow- able on the 4-lane cross- section, if acceptable pedestrian LOS can be maintained. 10' turn lanes suitable.	Should be provided, ideally 11' wide. In constrained situations, may be 10' wide.	Not a valid intersection type.

Table 5.1 Main Street Intersection Elements (continued)

Element:	Main/Main Intersections or Main Approach to Oth- er Intersection Types:	Avenue Approach to Main/Avenue Intersection:	Boulevard Approach to Main/Boulevard Intersection:	Parkway Approach to Main Street Intersection:
Dual Left-Turn Lanes	Inapplicable.	Inappropriate.	Inappropriate.	Not a valid intersection type.
Right-Turn Lanes	Inappropriate.	Inappropriate.	Inappropriate.	Not a valid intersection type.
Right-Turn Corner Islands	Inapplicable.	Inapplicable.	Inapplicable.	Not a valid intersection type.
Tapers	Inappropriate.	Inappropriate.	Inappropriate.	Not a valid intersection type.
Bicycle Lanes	Inapplicable. Bikes are expected to travel in mixed traffic.	Should be provided. 4' minimum. When onstreet parking exists along the segment, bike lanes should be 5' minimum, with 6' preferred. There should be a "receiving" lane on the opposite side of the intersection. Otherwise, the bike lane should be dropped just prior to the actual intersection, to allow the cyclist to safely merge. The bike lane should never be located to	Should be provided. 5' minimum. 6' preferred. There should be a "receiving" lane on the opposite side of the intersection. Otherwise, the bike lane should be dropped just prior to the actual intersection, to allow the cyclist to safely merge. The bike lane should never be located to the right of an exclusive vehicle turning lane.	Not a valid intersection type.

Main Street Intersection Elements (continued) Table 5.1

Element:	Main/Main Intersections	Avenue Approach to	Boulevard Approach to	Parkway Approach to Main
	or Main Approach to Oth-	Main/Avenue Intersec-	Main/Boulevard	Street Intersection:
	er Intersection Types:	tion:	Intersection:	
		the right of an exclusive vehicle turning lane.		
Curb Extensions	Should be provided at all corners, at same width as the on-street parking, except at far-side bus stops with high service frequencies.	Should be provided (at the same width as the onstreet parking) where full-time, on-street parking exists along the segment, except at far-side bus stops on 2-3 lane cross-sections.	Inappropriate.	Not a valid intersection type.
Bus Stops:	Typically located at far side of intersection.	Typically located at far side of intersection.	Typically located at far side of intersection.	Not a valid intersection type.
• Pullout	No.	No.	Consider for high frequency bus stop locations.	Not a valid intersection type.
• Curb Extension	Not allowable at far-side stops with high service frequencies. May be considered at other stop locations.	Yes, where full-time, on- street parking exists. Do not use at far-side on the 2-3 lane cross-sections.	No.	Not a valid intersection type.
Curb Radii	The intent in these pedestrian-oriented areas is to keep the curb radii small.	The intent in these pedestrian-oriented areas is to keep the curb radii small.	The intent in these pedestrian-oriented areas is to keep the curb radii	Not a valid intersection type.

Table 5.1 Main Street Intersection Elements (continued)

Element:	Main/Main Intersections	Avenue Approach to	Boulevard Approach to	Parkway Approach to Main
	or Main Approach to Oth-	Main/Avenue Intersec-	Main/Boulevard	Street Intersection:
	er Intersection Types:	tion:	Intersection:	
	(See Appendix C, "Curb	(See Appendix C, "Curb	small. (See Appendix C,	
	Radii" for details)	Radii" for details)	"Curb Radii" for details)	
ADA Ramps:				
• Type 1	No.	No.	No.	Not a valid intersection type.
• Type 2	Yes. See CDOT's Guide-	Yes. See CDOT's Guide-	Yes. See CDOT's Guide-	Not a valid intersection type.
1/1/-	lines for the Design and	lines for the Design and	lines for the Design and	
	Location of Accessible	Location of Accessible	Location of Accessible	
	Ramps for details and	Ramps for details and	Ramps for details and	
	explanations regarding	explanations regarding	explanations regarding	
	appropriate ramp designs	appropriate ramp designs	appropriate ramp designs	
	under varying circum-	under varying circum-	under varying circum-	
	stances.	stances.	stances.	
Crosswalks:	Should be provided on	Should be provided on	Should be provided on	Not a valid intersection type.
	all legs, unless there is	all legs, unless there is	all legs, unless there is	
	a physical restriction or	a physical restriction or	a physical restriction or	
	safety-related reason that	safety-related reason that	safety-related reason that	
	requires otherwise.	requires otherwise.	requires otherwise.	
 Marked 	Yes, always using en-	Yes, always using en-	Yes, always using en-	Not a valid intersection type.
	hanced marking or en-	hanced marking or en-	hanced marking, but not	
	hanced paving.	hanced paving.	enhanced paving.	

Main Street Intersection Elements (continued) Table 5.1

Element:	Main/Main Intersections	Avenue Approach to	Boulevard Approach to	Parkway Approach to Main
	or Main Approach to Oth-	Main/Avenue Intersec-	Main/Boulevard	Street Intersection:
	er Intersection Types:	tion:	Intersection:	
• Location	Should not be located on	Should not be located on	Should not be located on	Not a valid intersection type.
	the radius.	the radius.	the radius.	
Traffic Control:				
• Two-Way	No. A Main/Main inter-	No.	No.	Not a valid intersection type.
Stop	section, if stop-controlled,			
1	should be a four-way stop.			
• Four-Way	Allowable if both streets	Allowable if both streets	No.	Not a valid intersection type.
Stop	are two-lane and estab-	are two-lane and signal		
Стор	lished warrants are met.	warrants not met.		
• Roundabout	Allowable, except at inter-	Allowable, as a gateway	No.	Not a valid intersection type.
1.0 411 440 0 41	sections with Boulevards.	transition.		
 Signals 	Yes, depending on war-	Yes, depending on war-	Yes. Bus priority should	Not a valid intersection type.
	rants. Bus priority should	rants. Bus priority should	be used where appropri-	
	be used where appropri-	be used where appropriate.	ate.	
	ate.			
• Right-	No.	No.	No.	Not a valid intersection type.
Turn on Red				
Pedestrian	Yes, with countdown.	Yes, with countdown.	Yes, with countdown.	Not a valid intersection type.
Signals	Where possible, the	Where possible, the count-	Where possible, the	
01811410	countdown should show	down should show the	countdown should show	
	the total number of	total number of seconds	the total number of	

Table 5.1 Main Street Intersection Elements (continued)

Element:	Main/Main Intersections	Avenue Approach to	Boulevard Approach to	Parkway Approach to Main
	or Main Approach to Oth-	Main/Avenue Intersec-	Main/Boulevard	Street Intersection:
	er Intersection Types:	tion:	Intersection:	
	seconds available for	available for crossing.	seconds available for	
	crossing. Also consider	Also consider audible	crossing. Also consider	
	audible signals (where	signals (where deemed	audible signals (where	
	deemed appropriate) and	appropriate) and leading	deemed appropriate) and	
	leading pedestrian interval.	pedestrian interval.	leading pedestrian interval.	
Bicycle	Provide for all Main Street	Provide for through lanes	Provide for left turns.	Not a valid intersection type.
Detectors	approaches to signalized	and left turns.		••
Detectors	intersections.			
Advance	Yes, at signalized intersec-	Yes, at signalized intersec-	Yes, should be spaced to	Not a valid intersection type.
Stop Bars	tions. Should be spaced to	tions. Should be spaced to	allow clear separation and	
1	allow clear separation and	allow clear separation and	visibility between cars and	
	visibility between cars and	visibility between cars and	the crosswalk.	
	the crosswalk and, where	the crosswalk and, where		
	necessary, far enough	necessary, far enough back		
	back to allow additional	to allow additional maneu-		
	maneuvering space for	vering space for vehicles		
	vehicles turning off of the	turning off of the other		
	other street.	street.		
• Bike Box	Inapplicable, since bikes	Should be considered, but	Should be considered, but	Not a valid intersection type.
	are expected to travel in	only if a bike lane ap-	only if a bike lane ap-	
	mixed traffic.	proaches the intersection.	proaches the intersection.	

Main Street Intersection Elements (continued) Table 5.1

Element:	Main/Main Intersections or Main Approach to Oth-	Avenue Approach to Main/ Avenue Intersection:	Boulevard Approach to Main/Boulevard	Parkway Approach to Main Street Intersection:
	er Intersection Types:	This bike lane approach need not run the entire length of the segment.	Intersection: This bike lane approach need not run the entire length of the segment.	
Bicycle Stop Bars	Inapplicable, since bikes are expected to travel in mixed traffic.	Should be provided if there is a bike lane, but no bike box.	Should be provided if there is a bike lane, but no bike box.	Not a valid intersection type.
• Grade Separation	No.	No.	No.	Not a valid intersection type.
Lighting:	T		T	I
Street	Yes.	Yes.	Yes.	Not a valid intersection type.
• Pedestrian	Yes.	Yes.	Yes.	Not a valid intersection type.
Traffic Calming	Typically not necessary, but may be used to maintain desired speeds.	Consider a combination of elements on intersection approach to slow traffic approaching intersection. At the intersection, curb extensions may be used, for example (see "curb extensions", above, and CDOT's Traffic Calming Report for more information).	May be appropriate, if necessary to maintain desired speeds. Lateral shifts and some forms of narrowing may be considered. See CDOT's Traffic Calming Report for more information.	Not a valid intersection type.

5.2 Avenue Intersections

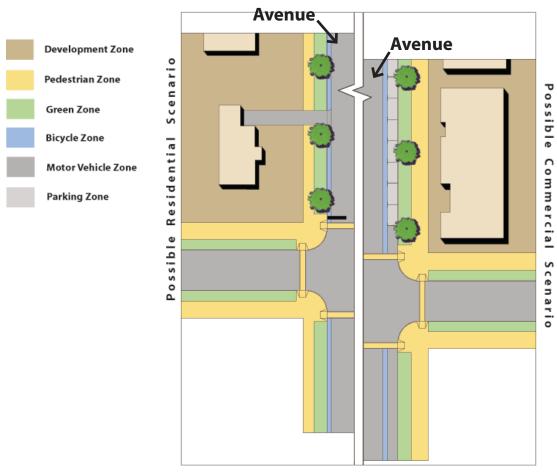
This section describes the features of all (non-local street) intersections that include at least one Avenue approach to the intersection. Avenues serve a wide variety of land uses and transportation functions. They are expected to provide a safety and comfort balance among the various modes in all contexts. The majority of non-local street intersections will be with Avenues. There are also several potential cross-sections for Avenues. The mix of possible land uses, cross-sections, and intersection types, along with the desire to provide a balance among the modes, makes Avenue intersections the most complicated in many respects. At intersections with Parkways, in particular, providing the necessary modal balance may prove difficult and plan/design teams might consider transitioning the Parkway to a Boulevard prior to the approach. A pedestrian-oriented Avenue should typically not intersect with a Parkway, if at all possible.

General Intent:

- (1) Design decisions will assess and compare the tradeoffs of safe and efficient travel for motorists, pedestrians, and cyclists.
- (2) Capacity increases or delay reductions at Avenue intersections will be carefully evaluated against the impacts to all travelers and their level-of-service, as well as the impacts on adjacent land uses.

The following table provides guidance in applying design elements to different types of Avenue intersections. The column headings refer to the various possible types of approach legs. The "Avenue Approach" column should be used to assess Avenue-to-Avenue intersections, as well as the Avenue approach to any of the other intersection types (Avenue-to-Main and Avenue-to-Boulevard). For a discussion of Avenues intersecting Local Streets, see "Local Street Intersections", Section 5.5.

Avenue Intersections 5.2



Avenue Intersections

Diagram reflects possible scenarios and intersection may vary slightly in design. For specific information refer to the guidelines on Table 4.2.

Table 5.2 Avenue Intersection Elements

Element:	Main Street Approach to	Avenue/Avenue Intersections	Boulevard Approach	Parkway Approach to
	Avenue/Main	or Avenue Approach to Other	Avenue/Boulevard	Avenue/Parkway
	Intersections:	Intersection Types:	Intersection:	Intersections:
Level of Service (L	OS):			
Pedestrian LOS Objective	LOS B for the entire Avenue/Main intersection.	LOS B for the entire Avenue/ Avenue intersection.	LOS B for the entire Avenue/Blvd intersection.	LOS D for the entire Avenue/Parkway inter- section.
Bicycle LOS Objective	LOS B for the entire Avenue/Main intersection, using the average LOS value of only the Avenue approaches (see Appendix A for details).	LOS B for the entire Avenue/ Avenue intersection.	LOS B for the entire Avenue/Blvd intersection.	LOS C/D for the entire Avenue/Parkway inter- section.
Motor Vehicle V/C Threshold	1.0, for two consecutive AM or PM hours, for the entire Avenue/Main intersection.	.95, for two consecutive AM or PM hours, for the entire Avenue/Avenue intersection.	.95, for two consecutive AM or PM hours, for the entire Avenue/Blvd intersection.	.95, for two consecutive AM or PM hours, for the entire Avenue/Park- way intersection.
Median	Atypical, but allowable under special circumstances (see Chapter 4, Section 4.1).	Atypical. When provided, should be a minimum width of 6' (for pedestrian refuge) at intersections (8' preferred if the Avenue has land uses likely to generate heavy pedestrian traffic).	Should be provided, with a minimum width of 6' (for pedestrian refuge) at the intersection (8' minimum if the Avenue approaches have land uses likely to generate pedestrian traffic across the Boulevard approaches).	Yes, preferably 9' wide at the intersection, 6' minimum (for pedestrian refuge). 8' minimum if Avenue approaches have land uses likely to generate pedestrian traffic across Parkway approaches.

Avenue Intersection Elements (continued) Table 5.2

Element:	Main Street Approach to Avenue/Main	Avenue/Avenue Intersections or Avenue Approach to Other	Boulevard Approach Avenue/Boulevard	Parkway Approach to Avenue/Parkway
	Intersections:	Intersection Types:	Intersection:	Intersections:
Pedestrian Refuge Island	Atypical, but allowable at signalized intersections, if necessary for traffic calming. Where provided, refuges should be a minimum of 6' wide, measured face-of-curb to face-of-curb.	. =	Yes, created by extending the median through the crosswalk (6' minimum, face-of curb to face-of-curb; 8' if Avenue approaches have land uses likely to generate pedestrian traffic across the Boulevard approaches).	Yes, created by extending the median to the crosswalk (6' minimum, face-of-curb to face-of-curb; 9' preferred; 8' minimum if Avenue approaches have land uses likely to generate pedestrian traffic across the Parkway approaches).
Number of Through Lanes	No more than 1 in each direction.	Typically, 1 to 2 lanes in each direction.	Typically, 2 lanes in each direction.	2 or 3 lanes in each direction.
Left-Turn Lane	Allowable only with the 3-lane Main Street cross-section. Typically, the turn lane will be 10' wide.	Will be provided with the 3-lane and the 5-lane cross-sections. Allowable on 4 lane cross-section. 10' turn lanes suitable.	Should be provided, ideally 11' wide. In constrained situations, may be 10' wide.	Should be provided, ideally 11' wide. In constrained conditions, may be a minimum of 10' wide. Should preferably include a 4' offset and an edge line, if there is no curb on the median.

Table 5.2 Avenue Intersection Elements (continued)

Element:	Main Street Approach to	Avenue/Avenue Intersections	Boulevard Approach	Parkway Approach to
	Avenue/Main	or Avenue Approach to Other	Avenue/Boulevard	Avenue/Parkway
	Intersections:	Intersection Types:	Intersection:	Intersections:
Dual Left-Turn	Inapplicable.	Inappropriate onto Main	Should be avoided. The	Even with the greater
Lanes		Streets. Should be avoided at	preferred option is to try	emphasis on vehicle
		other Avenue intersections.	the longest possible storage	capacity for Parkways,
		The preferred option is to	lane and green time for a	dual-lefts should be
		try the longest possible stor-	single left-turn first and/or	avoided onto Avenues,
		age lane and green time for a	to provide additional con-	as the overall dimen-
		single left-turn first and/or to	nections in the surround-	sions of the intersection
		provide additional connec-	ing street network. May be	can become detrimental
		tions in the surrounding street	considered:	to the Avenue environ-
		network. May be considered :	1) when turning move-	ment. The preferred
		1) when turning movements	ments are greater than	option is to try the
		are greater than through	through movements,	longest possible storage
		movements, thereby affording	thereby affording the possi-	lane and green time for
		the possibility to eliminate a	bility to eliminate a through	a single left-turn first
		through lane in exchange for	lane in exchange for the	and/or to provide ad-
		the dual left;	dual left;	ditional connections in
		2) when turning movements	2) when turning move-	the surrounding street
		are greater than 400 vehicles	ments are greater than 400	network.
		per hour;	vehicles per hour;	
			3) when it can be shown	
			that dual lefts will still per-	
			mit an acceptable	

Avenue Intersection Elements (continued) Table 5.2

Element:	Main Street Approach to Avenue/Main	Avenue/Avenue Intersections or Avenue Approach to Other	Boulevard Approach Avenue/Boulevard	Parkway Approach to Avenue/Parkway
	Intersections:	Intersection Types:	Intersection:	Intersections:
		3.) when it can be shown that dual lefts will still permit an acceptable pedestrian LOS to be maintained.	pedestrian LOS to be maintained.	
Right-Turn Lanes	Inappropriate.	Inappropriate at Main Street intersections. Discouraged at Avenue/Avenue intersections. The preferred option is to provide additional connections in the surrounding street network. May be considered: 1) when turning movements are greater than through movements, thereby affording the possibility to eliminate a through lane in exchange for right-turn lane; 2) when dropping a lane as the street cross-section changes;	Allowable. Where used, Florida slip-lane design, with corner islands, is the preferred treatment. The preferred option is to provide additional connections in the surrounding street network.	Although right-turn lanes are the ideal on Parkways, they should be very carefully considered and designed when they are allowing turns onto Avenues. Where used, Florida slip-lane design, with corner islands, is the preferred treatment.

Table 5.2 Avenue Intersection Elements (continued)

Element:	Main Street Approach to Avenue/Main Intersections:	Avenue/Avenue Intersections or Avenue Approach to Other Intersection Types: 3) when turning movements are greater than 300 vehicles per hour; 4) when acceptable pedestrian LOS can be maintained.	Boulevard Approach Avenue/Boulevard Intersection:	Parkway Approach to Avenue/Parkway Intersections:
Right-Turn Corner Islands	Inapplicable.	Inapplicable at Main Street intersections. Allowable at Avenue/Avenue and Avenue/Blvd, but only if necessary to maintain pedestrian LOS or as refuge on wide cross-sections. Where provided, should be a minimum of 50 sf., preferably landscaped.	Allowable, if necessary to maintain pedestrian LOS with the addition of a right-turn lane. Minimum of 50 sf.	Yes, in conjunction with Florida slip-lane design.
Tapers	Inappropriate.	Inappropriate.	Inappropriate.	Inappropriate.
Bicycle Lanes	Inapplicable. Bikes are expected to travel in mixed traffic.	Should be provided. 4' minimum. When on-street parking exists along the segment, bike lanes should be 5' minimum, with 6' preferred. There	Should be provided. 5' minimum. 6' preferred. May also be provided on a parallel frontage road, if that increases bicycle LOS.	Typically inappropriate, but may be allowable to maintain bicycle net- work connectivity (6' minimum for adequate

Avenue Intersection Elements (continued) Table 5.2

Element:	Main Street Approach to Avenue/Main	Avenue/Avenue Intersections or Avenue Approach to Other	Boulevard Approach Avenue/Boulevard	Parkway Approach to Avenue/Parkway
	Intersections:	Intersection Types:	Intersection:	Intersections:
		should be a "receiving" lane on the opposite side of the intersection. Otherwise, the bike lane should be dropped just prior to the actual intersection, to allow the cyclist to safely merge. The bike lane should never be located to the right of an exclusive vehicle turning lane.	There should be a "receiving" lane on the opposite side of the intersection. Otherwise, the bike lane should be dropped just prior to the actual intersection, to allow the cyclist to safely merge. The bike lane should never be located to the right of an exclusive vehicle turning lane.	separation from high- speed traffic). Pre- ferred option is to have separate facility outside of right-of-way or on parallel local streets.
Curb Extensions	Should be provided, at same width as the onstreet parking, except at far-side bus stops with high service frequencies.	Should be provided (at the same width as the on-street parking) where full-time, on-street parking exists along the segment, except at far-side bus stops on 2-3 lane cross-sections.	Inappropriate.	Prohibited.
Bus Stops:	Typically located at farside of intersections.	Typically located at far side of intersection.	Typically located at far side of intersection.	Typically located at off- street lots or stops. Far side stops preferred at intersections.

Table 5.2 Avenue Intersection Elements (continued)

Element:	Main Street Approach to	Avenue/Avenue Intersections	Boulevard Approach	Parkway Approach to
	Avenue/Main	or Avenue Approach to Other	Avenue/Boulevard	Avenue/Parkway
	Intersections:	Intersection Types:	Intersection:	Intersections:
• Pullout	No.	No.	Consider for high frequen-	Yes.
1 44210 444			cy bus stop locations.	
• Curb	Not allowable at far-side	Yes, where full-time, on-street	No.	No.
Extension	stops with high service	parking exists. Do not use at		
	frequencies. May be	far-side on the 2-3 lane cross-		
	considered at other stop	sections.		
	locations.			
Curb Radii	The intent in these pe-	The intent is to keep the curb	The intent is to keep the	The intent is to keep the
	destrian-oriented areas	radii as small as possible. See	curb radii as small as pos-	curb radii as small as
	is to keep the curb radii	Appendix C, "Curb Radii" for	sible. See Appendix C,	possible. See Appen-
	small. See Appendix C,	details.	"Curb Radii" for details.	dix C, "Curb Radii" for
	"Curb Radii" for details.			details.
ADA Ramps:				
• Type 1	No.	No.	No.	No.
• Type 2	Yes. See CDOT's Guide-	Yes. See CDOT's Guidelines	Yes. See CDOT's Guide-	Yes. See CDOT's Guide-
-/ -	lines for the Design and	for the Design and Location of	lines for the Design and Lo-	lines for the Design and
	Location of Accessible	Accessible Ramps for details	cation of Accessible Ramps	Location of Accessible
	Ramps for details and	and explanations regarding	for details and explanations	Ramps for details and
	explanations regard-	appropriate ramp designs un-	regarding appropriate ramp	explanations regard-
	ing appropriate ramp	der varying circumstances.	designs under varying cir-	ing appropriate ramp
	designs under varying		cumstances.	designs under varying

Avenue Intersection Elements (continued) Table 5.2

Element:	Main Street Approach to Avenue/Main Intersections:	Avenue/Avenue Intersections or Avenue Approach to Other Intersection Types:	Boulevard Approach Avenue/Boulevard Intersection:	Parkway Approach to Avenue/Parkway Intersections:
	circumstances.			circumstances.
Crosswalks:	Should be provided on all legs, unless there is a physical restriction or safety-related reason that requires otherwise.	Should be provided on all legs, unless there is a physical restriction or safety-related reason that requires otherwise.	Should be provided on all legs, unless there is a physical restriction or safety-related reason that requires otherwise.	Should be provided on all legs, unless there is a physical restriction or safety-related reason that requires otherwise.
• Marked	Yes, always using enhanced marking or enhanced paving.	Yes, always using enhanced marking or enhanced paving.	Yes, always using enhanced marking, but not enhanced paving.	Yes, always using enhanced marking, but not enhanced paving.
• Location	Should not be located on the radius.			
Traffic Control:				
• Two-Way Stop	No.	No.	No.	No.
• Four-Way Stop	Allowable if both streets are two-lane and established warrants are met.	Allowable if both streets are two-lane and signal warrants not met.	No.	No.

Table 5.2 Avenue Intersection Elements (continued)

Element:	Main Street Approach to Avenue/Main Intersections:	Avenue/Avenue Intersections or Avenue Approach to Other Intersection Types:	Boulevard Approach Avenue/Boulevard Intersection:	Parkway Approach to Avenue/Parkway Intersections:
• Round- about	Allowable as a gateway transition.	Allowable as a gateway transition at Main Streets. Allowable elsewhere, when: 1) volumes are less than 35,000; 2) analysis shows that roundabouts provide higher vehicle LOS than signals; and 3) provision of roundabout does not degrade pedestrian and bicycle LOS.	Allowable, when: 1) volumes are less than 35,000; 2) analysis shows that roundabouts provide higher vehicle LOS than signals; and 3) provision of roundabout does not degrade pedestrian and bicycle LOS.	No.
• Signals	Yes, depending on warrants. Bus priority should be used where appropriate.	Yes. Bus priority should be used where appropriate.	Yes. Bus priority should be used where appropriate.	Yes. Bus priority should be used where appropriate.
• Right-Turn on Red	No.	Not at Main Street intersections. Allowable at other intersections, but should be avoided in locations with a high potential for pedestrian traffic (in areas that are currently or are planned to be	Allowable, but should be avoided in locations with a high potential for pedestrian traffic (in areas that are currently or are planned to be pedestrian-oriented or mixed-use).	Desirable, depending on sight distance and potential for higher volume pedestrian traffic at the intersection.

Avenue Intersection Elements (continued) Table 5.2

Element:	Main Street Approach to Avenue/Main	Avenue/Avenue Intersections or Avenue Approach to Other	Boulevard Approach Avenue/Boulevard	Parkway Approach to Avenue/Parkway
	Intersections:	Intersection Types:	Intersection:	Intersections:
		pedestrian-oriented retail or mixed-use).		
• Pedestrian Signals	Yes, with countdown. Where possible, the countdown should show the total number of seconds available for crossing. Also consider audible signals (where deemed appropriate) and leading pedestrian interval.	Yes, with countdown. Where possible, the countdown should show the total number of seconds available for crossing. Also consider audible signals (where deemed appropriate) and leading pedestrian interval.	Yes, with countdown. Where possible, the countdown should show the total number of seconds available for crossing. Also consider audible signals (where deemed appropriate) and leading pedestrian interval.	Yes, with countdown. Where possible, the countdown should show the total number of seconds available for crossing. Also consider audible signals (where deemed appropriate).
Bicycle Detectors	Provide for all Main Street approaches to sig- nalized intersections.	Provide for through lanes and left-turns at Avenue/Main intersections. At Avenue/Avenue and Avenue/Blvd, provide for left-turns and on through lanes of the weaker approach legs.	Provide for left turns.	No.

Table 5.2 Avenue Intersection Elements (continued)

Element:	Main Street Approach to Avenue/Main Intersections:	Avenue/Avenue Intersections or Avenue Approach to Other Intersection Types:	Boulevard Approach Avenue/Boulevard Intersection:	Parkway Approach to Avenue/Parkway Intersections:
• Advance Stop Bars	Yes, at signalized intersections. Should be spaced to allow clear separation and visibility between cars and the crosswalk and, where necessary, far enough back to allow additional maneuvering space for vehicles turning off of the Avenue.	Yes. Should be spaced to allow clear separation and visibility between cars and the crosswalk and, where necessary, far enough back to allow maneuvering space for vehicles turning off of the other street. When right-turn-onred is allowed with the fourlane cross-section, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than is the inside lane's stop bar. This allows the turning driver to see approaching traffic without encroaching into the crosswalk.	Yes. Should be spaced to allow clear separation and visibility between cars and the crosswalk. When right-turn-on-red is allowed, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than are any adjacent lanes' stop bars. This allows the turning driver to see approaching traffic without encroaching into the crosswalk.	Allowable. Should be spaced to allow clear separation and visibility between cars and the crosswalk. When right-turn-on-red is allowed, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than are any adjacent lanes' stop bars. This allows the turning driver to see approaching traffic without encroaching into the crosswalk.
• Bike Box	Inapplicable, since bikes are expected to travel in mixed traffic.	Should be considered, but only if a bike lane approaches the intersection. This bike lane approach need not run	Should be considered, but only if a bike lane approaches the intersection. This bike lane approach	No. If a bike lane exists, use bicycle stop bars, rather than a bike box.

Avenue Intersection Elements (continued) Table 5.2

Element:	Main Street Approach to Avenue/Main Intersections:	Avenue/Avenue Intersections or Avenue Approach to Other Intersection Types: the entire length of the segment.	Boulevard Approach Avenue/Boulevard Intersection: need not run the entire length of the segment.	Parkway Approach to Avenue/Parkway Intersections:
Bicycle Stop Bars	Inapplicable, since bikes are expected to travel in mixed traffic.	Should be provided if there is a bike lane, but no bike box.	Should be provided if there is a bike lane, but no bike box.	Provide in the rare circumstance that a bike lane exists.
• Grade Separation Lighting	No.	No.	No.	No.
• Street	Yes.	Yes.	Yes.	Yes.
• Pedestrian	Yes	Should be provided where adjacent land uses or facilities are likely to cause concentrations of pedestrians (at bus stops or in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use, e.g.).	Should be provided where adjacent land uses or facilities are likely to cause concentrations of pedestrians (at bus stops or in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use, e.g.).	Atypical, but should be provided in any circumstance where adjacent land uses or facilities are likely to cause concentrations of pedestrians.

Table 5.2 Avenue Intersection Elements (continued)

Element:	Main Street Approach to Avenue/Main	Avenue/Avenue Intersections or Avenue Approach to Other	Boulevard Approach Avenue/Boulevard	Parkway Approach to Avenue/Parkway
	Intersections:	Intersection Types:	Intersection:	Intersections:
Traffic Calming	Typically not neces-	Consider a combination of	May be appropriate, if nec-	No.
	sary, but may be used to	elements on intersection	essary to maintain desired	
	maintain desired speeds.	approach to slow traffic ap-	speeds. Lateral shifts and	
		proaching intersection. At the	some forms of narrowing	
		intersection, curb extensions	may be considered. See	
		may be used, for example (see	CDOT's Traffic Calming	
		"curb extensions", above, and	Report for more informa-	
		CDOT's Traffic Calming Re-	tion.	
		port for more information).		

5.3 Boulevard Intersections

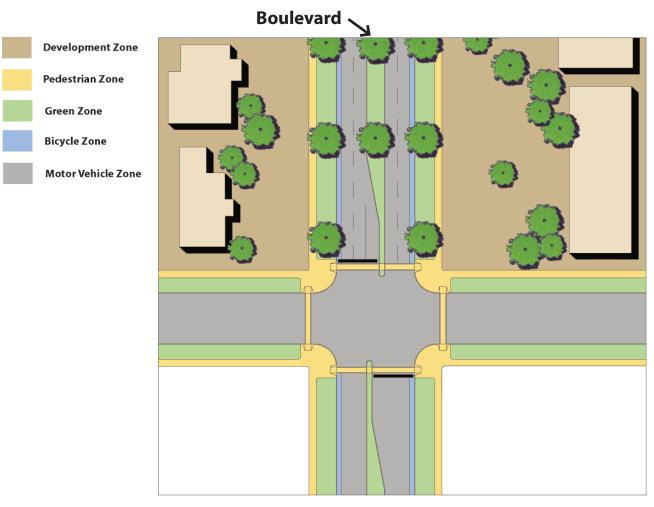
This section describes the features of all (non-local street) intersections that include at least one Boulevard approach to the intersection. Boulevards serve a wide variety of land uses, while providing important intra-city travel functions. Special care must be taken at Boulevard intersections with Main Streets and Avenues, because the higher speeds and volumes of the Boulevard must not overwhelm the pedestrian orientation of the Main Street and the desire for modal balance of the Avenue. This is an important point because the design solutions for the Boulevard approaches may be in conflict with the design requirements for the other approaches for these types of intersections.

General Intent:

- (1) Pedestrians and cyclists will be provided with a safe LOS at Boulevard intersections.
- (2) Designing for pedestrians will be particularly important where Boulevards intersect Main Streets and Avenues.
- (3) Boulevard intersections are likely to be fairly large, increasing the importance of aesthetics in their design.

The following table provides guidance in applying design elements to different types of Boulevard intersections. The column headings refer to the various possible types of approach legs. The "Boulevard Approach" column should be used to assess Boulevard-to-Boulevard intersections, as well as the Boulevard approach to any of the other intersection types (Boulevard-to-Main, Boulevard-to-Avenue, and Boulevard-to-Parkway). For a discussion of Boulevards intersecting Local Streets, see "Local Street Intersections", Section 5.5.

Boulevard Intersections 5.3



Boulevard Intersections

Diagram reflects possible scenarios and intersection may vary slightly in design. For specific information refer to the guidelines on Table 4.3.

Table 5.3 Boulevard Intersection Elements

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd. Approach to Other	Parkway Intersections:
			Intersection Types:	
Level of Service	(LOS):			
 Pedestrian 	LOS B for the entire Blvd/	LOS B for the entire Blvd/	LOS C for the entire Blvd/	LOS D for the entire Blvd/
	Main intersection.	Avenue intersection.	Blvd intersection.	Parkway intersection.
Bicycle	LOS B for the entire Blvd/	LOS B for the entire Blvd/	LOS C for the entire Blvd/	LOS C/D for the entire
, , , ,	Main intersection, using	Ave intersection.	Blvd intersection.	Blvd/Parkway intersection.
	the average LOS value of			
	only the Blvd approaches			
	(see Appendix A for de-			
	tails).			
• Motor	.95, for two consecutive	.95, for two consecutive AM	.95, for BOTH one AM and	.95, for BOTH one AM and
Vehicle	AM or PM hours, for the	or PM hours, for the entire	one PM hour, for the entire	one PM hour, for the entire
V/C	entire Blvd/Main intersec-	Blvd/Ave intersection.	Blvd/Blvd intersection.	Blvd/Parkway intersection.
Threshold	tion.			
Median	Atypical, but allowable	Atypical. When provided,	Should be provided, with	Yes, preferably 9' wide at the
	under special circum-	should be a minimum	a minimum width of 6'	intersection, 6' minimum
	stances. (Chapter 4, Sec-	width of 6' (for pedestrian	(for pedestrian refuge) at	(for pedestrian refuge).
	tion 4.1)	refuge) at intersections (8'	the intersection. 8' mini-	
		preferred if the Avenue	mum at Main Streets and	
		approaches have land uses	at Avenues if the Avenue	
		likely to generate heavy	approaches have land uses	
		pedestrian traffic).	likely to generate pedestrian	
			traffic across the Boulevard.	

Boulevard Intersection Elements (continued) Table 5.3

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd Approach to Other	Parkway Intersections:
			Intersection Types:	
Pedestrian	Atypical, but allowable	Consider when there are 4	Yes, created by extending	Yes, created by extending
Refuge Island	at signalized intersec-	or more lanes on the ap-	the median through the	the median to the crosswalk
	tions, if necessary for	proach. To be provided	crosswalk (6' min. width,	(6' minimum, face-of-curb
	traffic calming. Where	either by extending the	face-of-curb to face-of-	to face-of-curb; 9' pre-
	provided, refuges should	median to the crosswalk or	curb; 8' under conditions	ferred).
	be a minimum of 6' wide,	by providing a separate, 6'	described above for "medi-	
	measured face-of-curb to	minimum, pedestrian ref-	ans").	
	face-of-curb.	uge (measured face-of-curb		
		to face-of-curb).		
Number of	No more than 1 in each	Typically, 1 to 2 lanes in	Typically, 2 lanes in each	2 or 3 lanes in each direc-
Through Lanes	direction.	each direction.	direction.	tion.
Left-Turn Lane	Allowable only with the	Will be provided with the	Should be provided, ideally	Should be provided, ideally
	3-lane Main Street cross-	3-lane and the 5-lane cross-	11' wide. In constrained	11' wide. In constrained
	section. Typically, the	sections. Allowable on 4	situations, may be 10' wide.	conditions, may be a mini-
	turn lane will be 10' wide.	lane cross-section. 10' turn		mum of 10' wide. Should
		lanes suitable.		preferably include a 4' offset
				and an edge line, if there is
				no curb on the median.

Table 5.3 Boulevard Intersection Elements (continued)

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd Approach to Other	Parkway Intersections:
			Intersection Types:	
Dual Left-Turn	Inapplicable.	Should be avoided. The	Inappropriate onto Main	Allowable, though the
Lanes		preferred option is to try	Streets. Allowable onto	overall dimensions of the
		the longest possible storage	Parkways. Should be avoid-	intersection can become
		lane and green time for a	ed onto Avenues and other	detrimental to the Bou-
		single left-turn first and/or	Boulevards. The preferred	levard environment. The
		to provide additional con-	option is to try the longest	preferred option is to try the
		nections in the surround-	possible storage lane and	longest possible storage lane
		ing street network. May be	green time for a single left-	and green time for a single
		considered:	turn first and/or to provide	left-turn first and/or to pro-
		1) when turning move-	additional connections in	vide additional connections
		ments are greater than	the surrounding street net-	in the surrounding street
		through movements,	work. May be considered:	network.
		thereby affording the possi-	1) when turning move-	
		bility to eliminate a through	ments are greater than	
		lane in exchange for the	through movements,	
		dual left;	thereby affording the possi-	
		2) when turning move-	bility to eliminate a through	
		ments are greater than 400	lane in exchange for the	
		vehicles per hour;	dual left;	
			2) when turning move-	
			ments are greater than 400	
			vehicles per hour;	

Boulevard Intersection Elements (continued) Table 5.3

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd Approach to Other	Parkway Intersections:
			Intersection Types:	
		3) when it can be shown	3) when it can be shown	
		that dual lefts will still per-	that dual lefts will still per-	
		mit an acceptable pedestri-	mit an acceptable pedestri-	
		an LOS to be maintained.	an LOS to be maintained.	
Right-Turn	Inappropriate.	To be avoided. The pre-	Inappropriate onto Main	Yes. Where used, Florida
Lanes		ferred option is to provide	Streets. Allowable onto	slip-lane design, with corner
		additional connections in	Avenues, other Boulevards,	islands, is the preferred
		the surrounding street net-	and Parkways, when neces-	treatment. In constrained
		work. May be considered:	sary to meet vehicle LOS.	conditions, provide right
		1) when turning move-	The preferred option is to	turn deceleration lanes at a
		ments are greater than	provide additional connec-	minimum.
		through movements, there-	tions in the surrounding	
		by affording the possibility	street network. Where	
		to eliminate a through lane	used, Florida slip-lane	
		in exchange for right-turn	design, with corner islands,	
		lane;	is the preferred treatment.	
		2) when dropping a lane	Not to be used for entrances	
		as the street cross-section	to commercial properties.	
		changes;		

Table 5.3 Boulevard Intersection Elements (continued)

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd Approach to Other	Parkway Intersections:
			Intersection Types:	
		3) when turning move-		
		ments are greater than 300		
		vehicles per hour;		
		4) when acceptable pedes-		
		trian LOS can be main-		
		tained.		
Right-Turn	Inapplicable.	Allowable, if necessary to	Allowable, if necessary to	Yes, in conjunction with
Corner Islands		maintain pedestrian LOS	maintain pedestrian LOS,	Florida slip-lane design.
		with a turn lane or as refuge	particularly in conjunction	
		on wide cross-sections.	with Florida slip-lane de-	
		Where provided, should be	sign. Minimum of 50 sf.	
		a minimum of 50 sf., prefer-		
		ably landscaped.		
Tapers	Inappropriate.	Inappropriate.	Inappropriate onto Main	Allowable.
			Streets or Avenues. Inap-	
			propriate in most circum-	
			stances at other Boulevards.	
			Allowable at Parkways.	
Bicycle Lanes	Inapplicable. Bikes are ex-	Should be provided. 4'	Should be provided. 5'	Typically inappropriate, but
	pected to travel in mixed	min. When on-street park-	minimum. 6' preferred.	may be allowable to main-
	traffic.	ing exists along the seg-	May also be provided on a	tain bicycle network con-
		ment, bike lanes should be	parallel frontage road, if	nectivity (6' minimum

Boulevard Intersection Elements (continued) Table 5.3

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd Approach to Other	Parkway Intersections:
			Intersection Types:	
		5' minimum with 6' pre-	that increases bicycle LOS.	for adequate separation
		ferred. There should be a	There should be a "receiv-	from high-speed traffic).
		"receiving" lane on the op-	ing" lane on the opposite	Preferred option is to have
		posite side of the intersec-	side of the intersection.	separate facility outside of
		tion. Otherwise, the bike	Otherwise, the bike lane	right-of-way or on parallel
		lane should be dropped just	should be dropped just	local streets.
		prior to the actual intersec-	prior to the actual intersec-	
		tion, to allow the cyclist to	tion to allow the cyclist to	
		safely merge. The bike lane	safely merge. The bike lane	
		should never be located to	should never be located to	
		the right of an exclusive	the right of an exclusive	
		vehicle turning lane.	vehicle turning lane.	
Curb	Should be provided, at	Should be provided (at the	Inappropriate.	Prohibited.
Extensions	same width as the on-street	same width as the on-street		
	parking, except at far-side	parking) where full-time		
	bus stops with high service frequencies.	on-street parking exists along the segment, except at		
	frequencies.	far-side bus stops on 2-3 lane		
		cross-sections.		
Bus Stops:	Typically located at far	Typically located at far side	Typically located at far side	Typically located at off-
	side of intersection.	of intersection.	of intersection.	street lots or stops. Far side
				stops preferred at intersec-
				tions.

Table 5.3 Boulevard Intersection Elements (continued)

Element:	Main Street Approach to Blvd/Main Intersections:	Avenue Approach to Blvd/Avenue Intersections:	Blvd/Blvd Intersections or Blvd Approach to Other	Parkway Approach to Blvd/ Parkway Intersections:
			Intersection Types:	
• Pullout	No.	No.	Consider for high frequency bus stop locations.	Yes.
• Curb Extension	Not allowable at far-side stops with high service frequencies. May be considered at other stop locations.	Yes, where full-time, on- street parking exists. Do not use at far-side on the 2-3 lane cross-sections.	No.	No.
Curb Radii	The intent in these pedestrian-oriented areas is to keep the curb radii as small as possible. See Appendix C, "Curb Radii" for details.	The intent is to keep the curb radii as small as possible. See Appendix C, "Curb Radii" for details.	The intent is to keep the curb radii as small as possible. See Appendix C, "Curb Radii" for details.	The intent is to keep the curb radii as small as possible. See Appendix C, "Curb Radii" for details.
ADA Ramps:				
• Type 1	No.	No.	No.	No.
• Type 2	Yes. See CDOT's Guide- lines for the Design and Location of Accessible Ramps for details and explanations regarding appropriate ramp designs	Yes. See CDOT's Guide- lines for the Design and Lo- cation of Accessible Ramps for details and explanations regarding appropriate ramp designs under varying	Yes. See CDOT's Guide- lines for the Design and Lo- cation of Accessible Ramps for details and explanations regarding appropriate ramp designs under varying	Yes. See CDOT's Guide- lines for the Design and Lo- cation of Accessible Ramps for details and explanations regarding appropriate ramp designs under varying

Boulevard Intersection Elements (continued) Table 5.3

Element:	Main Street Approach to Blvd/Main Intersections:	Avenue Approach to Blvd/Avenue Intersections:	Blvd/Blvd Intersections or Blvd Approach to Other Intersection Types:	Parkway Approach to Blvd/ Parkway Intersections:
• Type 2	under varying circum- stances.	circumstances.	circumstances.	circumstances.
Crosswalks:	Should be provided on all legs, unless there is a physical restriction or safety-related reason that requires otherwise.	Should be provided on all legs, unless there is a physical restriction or safetyelated reason that requires otherwise.	Should be provided on all legs, unless there is a physical restriction or safety-related reason that requires otherwise.	Should be provided on all legs, unless there is a physical restriction or safety-related reason that requires otherwise.
• Marked	Yes, always using en- hanced marking or en- hanced paving.	Yes, always using enhanced marking or enhanced paving.	Yes, always using enhanced marking, but not enhanced paving.	Yes, always using enhanced marking, but not enhanced paving.
• Location	Should not be located on the radius.	Should not be located on the radius.	Should not be located on the radius.	Should not be located on the radius.
Traffic Control:				
• Two-Way Stop	No.	No.	No.	No.
• Four-Way Stop	Yes, if both streets are two-lane.	Allowable if both streets are two-lane and signal warrants not met.	No.	No.
• Round- about	No.	Allowable, when: 1) volumes are less than 35,000	Inappropriate at Main Streets and Parkways. Al- lowable at Avenues and	No.

Table 5.3 Boulevard Intersection Elements (continued)

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd Approach to Other	Parkway Intersections:
			Intersection Types:	
	No.	2) analysis shows that	other Boulevards, when:	No.
		roundabouts provide higher	1) volumes are less than	
		vehicle LOS than signals;	35,000;	
		and	2) analysis shows that	
		3) provision of roundabout	roundabouts provide	
		does not degrade pedes-	higher vehicle LOS than	
		trian and bicycle LOS.	signals; and	
			3) provision of roundabout	
			does not degrade pedes-	
			trian and bicycle LOS.	
 Signals 	Yes, depending on war-	Yes. Bus priority should be	Yes. Bus priority should be	Yes. Bus priority should be
8	rants. Bus priority should	used where appropriate.	used where appropriate.	used where appropriate.
	be used where appropri-			
	ate.			
• Right-	No.	Allowable, but should be	Desirable at Blvd/Blvd and	Desirable, depending on
Turn on		avoided in locations with	Blvd/Parkway intersections,	sight distance and potential
Red		a high potential for pedes-	depending on sight distance	for higher volume pedestri-
		trian traffic (in areas that	and pedestrian volumes.	an traffic at the intersection.
		are currently or are planned	Avoid with opposite dual	
		to be pedestrian-oriented	lefts. Allowable at Blvd/	
		retail or mixed-use).	Avenue intersections, but	
			should be avoided in	

Boulevard Intersection Elements (continued) Table 5.3

vay Approach to Blvd
vay Intersections:
ith countdown.
e possible, the count-
should show the total
er of seconds available
ossing. Also con-
audible signals (where
ed appropriate).

Table 5.3 Boulevard Intersection Elements (continued)

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd Approach to Other	Parkway Intersections:
			Intersection Types:	
• Advance Stop Bars	Yes, at signalized intersections. Should be spaced to allow clear separation and visibility between cars and the crosswalk and, where necessary, far enough back to allow additional maneuvering space for vehicles turning off of the Boulevard.	Yes. Should be spaced to allow clear separation and visibility between cars and the crosswalk and, where necessary, far enough back to allow additional maneuvering space for vehicles turning off of the Boulevard. When right-turn-on-red is allowed with the four-lane cross-section, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than is the inside lane's stop bar. This allows the turning driver to see approaching traffic without encroaching into the crosswalk.	Intersection Types: Yes. Should be spaced to allow clear separation and visibility between cars and the crosswalk. When right-turn-on-red is allowed, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than are any adjacent lanes' stop bars. This allows the turning driver to see approaching traffic without encroaching into the crosswalk.	Allowable. Should be spaced to allow clear separation and visibility between cars and the crosswalk. When right-turn-on-red is allowed, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than are any adjacent lanes' stop bars. This allows the turning driver to see approaching traffic without encroaching into the crosswalk.

Boulevard Intersection Elements (continued) Table 5.3

Element:	Main Street Approach to Blvd/Main Intersections:	Avenue Approach to Blvd/Avenue Intersections:	Blvd/Blvd Intersections or Blvd Approach to Other Intersection Types:	Parkway Approach to Blvd/ Parkway Intersections:
• Bike Box	Inapplicable, since bikes are expected to travel in mixed traffic.	Should be considered, but only if a bike lane approaches the intersection. This bike lane approach need not run the entire length of the segment.	Should be considered, but only if a bike lane approaches the intersection. This bike lane approach need not run the entire length of the segment.	No. If a bike lane exists, use bicycle stop bars, rather than a bike box.
Bicycle Stop Bars	Inapplicable, since bikes are expected to travel in mixed traffic.	Should be provided if there is a bike lane, but no bike box.	Should be provided if there is a bike lane, but no bike box.	Provide in the rare circumstance that a bike lane exists.
• Grade Separation	No.	No.	No.	No.
Lighting:				
• Street	Yes.	Yes.	Yes.	Yes.
• Pedestrian	Yes.	Should be provided where adjacent land uses or facilities are likely to cause concentrations of pedestrians (at bus stops or in areas that are currently or planned	Yes, at Main Streets. Optional at Blvd/Blvd, Blvd/Ave. Atypical at Parkways. Should be provided where adjacent land uses or facilities are likely to cause	Atypical, but should be provided in any circumstance where adjacent land uses or facilities are likely to cause concentrations of pedestrians.

Table 5.3 Boulevard Intersection Elements (continued)

Element:	Main Street Approach to	Avenue Approach to	Blvd/Blvd Intersections or	Parkway Approach to Blvd/
	Blvd/Main Intersections:	Blvd/Avenue Intersections:	Blvd Approach to Other	Parkway Intersections:
			Intersection Types:	
		to be pedestrian-oriented	concentrations of pedestri-	
		retail or mixed-use).	ans (at bus stops or in areas	
			that are currently or are	
			planned to be pedestrian-	
			oriented retail or mixed-	
			use).	
Traffic Calming	Typically not necessary,	Consider a combination of	May be appropriate, if nec-	No.
	but may be used to main-	elements on intersection	essary to maintain desired	
	tain desired speeds.	approach to slow traffic	speeds. Lateral shifts and	
		approaching intersection.	some forms of narrowing	
		At the intersection, curb	may be considered. See	
		extensions may be used, for	CDOT's Traffic Calming	
		example (see "Curb Exten-	Report for more informa-	
		sions", above, and CDOT's	tion.	
		Traffic Calming Report for		
		more information).		

5.4 Parkway Intersections

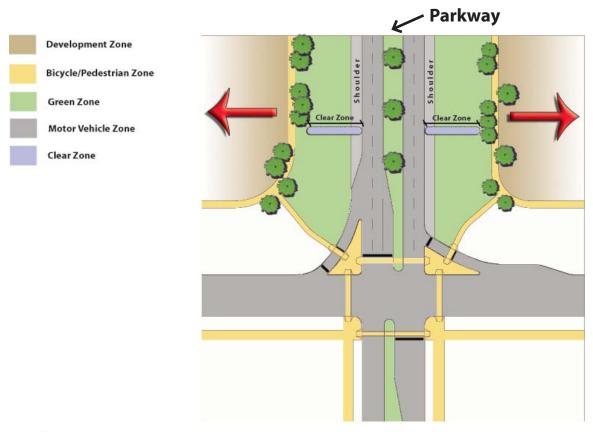
This section describes the features of all (non-local street) intersections that include at least one Parkway approach to the intersection. Parkways serve as high-volume, relatively high-speed intra-urban thoroughfares. Adjacent land uses are assumed to be auto-oriented in both type and design, with access control much more prevalent than on any other street type. Parkways may intersect with all other street types, except Main Streets. While the basic design of a Parkway intersection is intended to serve high volumes of traffic, some design elements may be adjusted to reflect the type of street the Parkway is intersecting.

General Intent:

- (1) Providing motor vehicle capacity and reducing travel delay is a major design goal for Parkway intersections.
- (2) Safety for all users is another important goal, even though motor vehicle level-of-service is emphasized.
- (3) Land uses that would generate large numbers of pedestrians wanting to cross the Parkway should be limited near Parkway intersections.

The following table provides guidance in applying design elements to different types of Parkway intersections. The column headings refer to the various possible types of approach legs. The "Parkway Approach" column should be used to assess Parkway-to-Parkway intersections, as well as the Parkway approach to any of the other intersection types (Parkway-to-Avenue, and Parkway-to-Boulevard). For a discussion of Parkways intersecting Local Streets, see "Local Street Intersections", Section 5.5.

Parkway Intersections 5.4



Parkway Intersections

Diagram reflects possible scenarios and intersection may vary slightly in design. For specific information refer to the guidelines on Table 4.4.

Table 5.4 Parkway Intersection Elements

Element:	Main Street Approach:	Avenue Approach to Parkway/Avenue Intersection:	Boulevard Approach to Parkway/Boulevard Intersection:	Pkwy/Pkwy Intersection or Parkway Approach to Other Intersection Types :
Level of Service (L	OS):			
Pedestrian LOS Objective	Not a valid intersection type.	LOS D for the entire Parkway/ Avenue intersection.	LOS D for the entire Parkway/Boulevard intersection.	LOS D for the entire Parkway/ Parkway intersection.
Bicycle LOS Objective	Not a valid intersection type.	LOS C/D for the entire Parkway/Avenue intersection.	LOS C/D for the entire Parkway/Boulevard inter- section.	LOS D for the entire Parkway/ Parkway intersection.
Motor Vehicle V/C Threshold	Not a valid intersection type.	.95, for two consecutive AM or PM hours, for the entire Parkway/Avenue intersection.	.95, for BOTH one AM and one PM hour, for the entire Parkway/Blvd intersection.	.90, for BOTH one AM and one PM hour, for the entire Parkway/Parkway intersection.
Median	Not a valid intersection type.	Atypical. When provided, should be a minimum width of 6' (for pedestrian refuge) at intersections (8' preferred if the Avenue approaches have land uses likely to generate heavy pedestrian traffic).	Should be provided, with a minimum width of 6' (for pedestrian refuge) at the intersection.	Yes, preferably 9' wide at the intersection, 6' minimum. 8' minimum at Avenues (for pedestrian refuge) if Avenue approaches have land uses likely to generate pedestrian traffic across the Parkway approaches.
Pedestrian Refuge Island	Not a valid intersection type.	Consider when there are 4 or more lanes on the approach. To be provided either by extending the	Yes, created by extending the median through the crosswalk (6' minimum	Yes, created by extending the median to the crosswalk (6'-8 minimum as described

Parkway Intersection Elements (continued) Table 5.4

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types :
		median to the crosswalk or	width, face-of-curb to face-	above for medians, 9' pre-
		by providing a separate, 6'	of-curb).	ferred).
		minimum, pedestrian refuge,		
		measured face-of-curb to face-		
		of-curb.		
Number of	Not a valid intersec-	Typically, 1 to 2 lanes in each	Typically 2 lanes in each	2 or 3 lanes in each direction.
Through Lanes	tion type.	direction.	direction.	
Left-Turn Lane	Not a valid intersec-	Will be provided with the	Should be provided, ideally	Should be provided, ideally
	tion type.	3-lane or the 5-lane cross-	11' wide. In constrained	11' wide. In constrained con-
		sections. Allowable on 4 lane	situations, may be 10' wide.	ditions, may be a minimum of
		cross-section. 10' turn lanes		10' wide. Should preferably
		suitable.		include a 4' offset and an edge
				line, if there is no curb on the
				median.
Dual Left-Turn	Not a valid intersec-	Should be avoided. The pre-	Allowable. The preferred	Allowable, though the overall
Lanes	tion type.	ferred option is to try the lon-	option is to try the longest	dimensions of the intersection
		gest possible storage lane and	possible storage lane and	can become detrimental to the
		green time for a single left-	green time for a single left-	Avenue or Boulevard environ-
		turn first and/or to provide	turn first and/or to provide	ments. The preferred option
		additional connections in the	additional connections	is to try the longest possible
		surrounding street network.	in the surrounding street	storage lane and green time
		May be considered:	network.	for

Table 5.4 Parkway Intersection Elements (continued)

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types :
		1) when turning movements		a single left-turn first and/or
		are greater than through		to provide additional connec-
		movements, thereby affording		tions in the surrounding street
		the possibility to eliminate a		network.
		through lane in exchange for		
		the dual left;		
		2) when turning movements		
		are greater than 400 vehicles		
		per hour;		
		3) when it can be shown that		
		dual lefts will still permit an		
		acceptable pedestrian LOS to		
		be maintained.		
Right-Turn	Not a valid intersec-	To be avoided. The preferred	Allowable, when necessary	Yes, though they should be
Lanes	tion type.	option is to provide additional	to meet vehicle LOS. The	very carefully considered
		connections in the surround-	preferred option is to pro-	and designed when they are
		ing street network. May be	vide additional connections	allowing turns onto Avenues.
		considered:	in the surrounding street	Where used, Florida slip-lane
		1) when turning movements	network. Where used,	design, with corner islands,
		are greater than through	Florida slip-lane design,	is the preferred treatment.
		movements, thereby affording	with corner islands, is the	In constrained conditions,
		the possibility to eliminate a	preferred	provide

Parkway Intersection Elements (continued) Table 5.4

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types :
		through lane in exchange for	treatment. Not to be used	right turn deceleration lanes at
		right-turn lane;	for entrances to commer-	a minimum.
		2) when dropping a lane as the	cial properties.	
		street cross-section changes;		
		3) when turning movements		
		are greater than 300 vehicles		
		per hour;		
		4) when acceptable pedestrian		
		LOS can be maintained.		
Right-Turn	Not a valid intersec-	Allowable, if necessary to	Allowable, if necessary to	Yes, in conjunction with
Corner Islands	tion type.	maintain pedestrian LOS	maintain pedestrian LOS,	Florida slip-lane design.
		with a turn lane or as ref-	particularly in conjunc-	
		uge on wide cross-sections.	tion with Florida slip-lane	
		Where provided, should be a	design. Minimum of 50 sf.	
		minimum of 50 sf., preferably		
		landscaped.		
Tapers	Not a valid intersec-	Inappropriate.	Allowable.	Inappropriate onto Avenues.
	tion type.			Allowable onto Boulevards or
				other Parkways.
Bicycle Lanes	Not a valid intersec-	Should be provided. 4' mini-	Should be provided. 5'	Typically inappropriate, but
	tion type.	mum. When on-street parking	minimum. 6' preferred.	may be allowable to maintain
		exists along the segment, bike	May also be provided on	bicycle network

Table 5.4 Parkway Intersection Elements (continued)

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types :
		lanes should be 5' minimum,	a parallel frontage road, if	connectivity (6' minimum,
		with 6' preferred. There	that increases bicycle LOS.	for adequate separation from
		should be a "receiving" lane on	There should be a "receiv-	high-speed traffic). Preferred
		the opposite side of the inter-	ing" lane on the opposite	option is to have separate
		section. Otherwise, the bike	side of the intersection.	facility outside of right-of-way
		lane should be dropped just	Otherwise, the bike lane	or on parallel local streets.
		prior to the actual intersection,	should be dropped just	
		to allow the cyclist to safely	prior to the actual intersec-	
		merge. The bike lane should	tion, to allow the cyclist to	
		never be located to the right	safely merge. The bike lane	
		of an exclusive vehicle turning	should never be located to	
		lane.	the right of an exclusive	
			vehicle turning lane.	
Curb Extensions	Not a valid intersec-	7' extensions should be pro-	Inappropriate.	Prohibited.
	tion type.	vided where full-time, on-		
		street parking exists along the		
		segment, except at far-side bus		
		stops on 2-3 lane cross-sec-		
		tions.		
Bus Stops:	Not a valid intersec-	Typically located at far side of	Typically located at far side	Typically located at off-street
	tion type.	intersection.	of intersection.	lots or stops. Far side stops
				preferred at intersections.

Parkway Intersection Elements (continued) Table 5.4

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types :
• Pullout	Not a valid intersec-	No.	Consider for high frequen-	Yes.
	tion type.		cy bus stop locations.	
• Curb	Not a valid intersec-	Should be provided (at the	No.	No.
Extension	tion type.	same width as the on-street		
		parking) where full-time, on-		
		street parking exists. Do not		
		use at far-side on the 2-3 lane		
		cross-sections.		
Curb Radii	Not a valid intersec-	The intent is to keep the curb	The intent is to keep the	The intent is to keep the curb
	tion type.	radii as small as possible. See	curb radii as small as pos-	radii as small as possible. See
		Appendix C, "Curb Radii" for	sible. See Appendix C,	Appendix C, "Curb Radii" for
		details.	"Curb Radii" for details.	details.
ADA Ramps:				
• Type 1	Not a valid intersec-	No.	No.	No.
1) pe 1	tion type.			
• Type 2	Not a valid intersec-	Yes. See CDOT's Guidelines	Yes. See CDOT's Guide-	Yes, if crosswalks are provid-
1)102	tion type.	for the Design and Location of	lines for the Design and	ed. See CDOT's Guidelines
		Accessible Ramps for details	Location of Accessible	for the Design and Location of
		and explanations regarding ap-	Ramps for details and ex-	Accessible Ramps for details
		propriate ramp designs under	planations regarding appro-	and explanations regarding
		varying circumstances.	priate ramp designs under	appropriate ramp designs un-
			varying circumstances.	der varying circumstances.

Table 5.4 Parkway Intersection Elements (continued)

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types :
Crosswalks:	Not a valid intersec-	Should be provided on all	Should be provided on all	Should be provided on all legs
	tion type.	legs, unless there is a physical	legs, unless there is a physi-	where there are sidewalks, un-
		restriction or safety-related	cal restriction or safety-re-	less there is a physical
		reason that requires otherwise.	lated reason that requires	restriction or safety-related rea-
			otherwise.	son that requires otherwise.
 Marked 	Not a valid intersec-	Yes, always using enhanced	Yes, always using enhanced	Yes, always using enhanced
	tion type.	marking or enhanced paving.	marking, but not enhanced	marking, but not enhanced
			paving.	paving.
• Location	Not a valid intersec-	Should not be located on the	Should not be located on	Should not be located on the
	tion type.	radius.	the radius.	radius.
Traffic Control:				
• Two-Way	Not a valid intersec-	No.	No.	No.
Stop	tion type.			
• Four-Way	Not a valid intersec-	Allowable if both streets are	No.	No.
Stop	tion type.	two-lane and signal warrants		
otop .		not met.		
• Round-	Not a valid intersec-	No.	No.	No.
about	tion type.			
112 5 225				

Parkway Intersection Elements (continued) Table 5.4

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types:
• Signals	Not a valid intersec-	Yes. Bus priority should be	Yes. Bus priority should be	Yes. Bus priority should be
8	tion type.	used where appropriate.	used where appropriate.	used where appropriate.
• Right-Turn	Not a valid intersec-	Allowable, but should be	Desirable, depending on	Desirable, depending on sight
on Red	tion type.	avoided in locations with a	sight distance and pedes-	distance and potential for
		high potential for pedestrian	trian volumes. Avoid with	higher volume pedestrian traf
		traffic (in areas that are cur-	opposite dual lefts.	fic at the intersection (apply
		rently or are planned to be		carefully at Avenues).
		pedestrian-oriented retail or		
		mixed-use).		
 Pedestrian 	Not a valid intersec-	Yes, with countdown. Where	Yes, with countdown.	Yes, where crosswalks exist at
Signals	tion type.	possible, the countdown	Where possible, the count-	the intersection, with count-
		should show the total number	down should show the total	down. Where possible, the
		of seconds available for cross-	number of seconds avail-	countdown should show the
		ing. Also consider audible	able for crossing. Also con-	total number of seconds avail-
		signals (where deemed appro-	sider audible signals (where	able for crossing. Also con-
		priate) and leading pedestrian	deemed appropriate) and	sider audible signals (where
		interval.	leading pedestrian interval.	deemed appropriate).
			Will typically be actuated.	
• Bicycle	Not a valid intersec-	Provide on through lanes of	Provide on through lanes of	No.
Detectors	tion type.	the weaker approach legs.	the weaker approach legs.	

Table 5.4 Parkway Intersection Elements (continued)

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types:
Advance Stop Bars	Not a valid intersection type.	Yes. Should be spaced to allow clear separation and visibility between cars and the crosswalk and, where necessary, far enough back to allow maneuvering space for vehicles turning off of the Parkway. When right-turn-on-red is allowed with the four-lane cross-section, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than is the inside lane's stop bar. This allows the turning driver to see approaching	Yes. Should be spaced to allow clear separation and visibility between cars and the crosswalk. When right-turn-on-red is allowed, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than are any adjacent lanes' stop bars. This allows the turning driver to see approaching traffic without encroaching into the crosswalk.	Allowable. Should be spaced to allow clear separation and visibility between cars and the crosswalk. When right-turn-on-red is allowed, stagger the stop bars, so that the outside, turning lane's stop bar is closer to the crosswalk than are any adjacent lanes' stop bars. This allows the turning driver to see approaching traffic without encroaching into the crosswalk.
		traffic without encroaching into the crosswalk.		
Bike Box	Not a valid intersection type.	Should be considered, but only if a bike lane approaches the intersection. This bike lane approach need not run the	Should be considered, but only if a bike lane approaches the intersection. This bike lane approach	No. If a bike lane exists, use bicycle stop bars, rather than a bike box.

Parkway Intersection Elements (continued) Table 5.4

Element:	Main Street Approach:	Avenue Approach to Parkway/Avenue Intersection: entire length of the segment.	Boulevard Approach to Parkway/Boulevard Intersection: need not run the entire	Pkwy/Pkwy Intersection or Parkway Approach to Other Intersection Types :
Bicycle Stop Bars	Not a valid intersection type.	Should be provided if there is a bike lane, but no bike box.	length of the segment. Should be provided if there is a bike lane, but no bike box.	Provide in the rare circumstance that a bike lane exists.
• Grade Separation	Not a valid intersection type.	No.	No.	Allowable, for Parkway/Parkway. No for other intersections.
Lighting:				
• Street	Not a valid intersection type.	Yes.	Yes.	Yes.
• Pedestrian	Not a valid intersection type.	Optional. Should be provided where adjacent land uses or facilities are likely to cause concentrations of pedestrians (at bus stops or in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use, e.g.).	Atypical. Should be provided where adjacent land uses or facilities are likely to cause concentrations of pedestrians (at bus stops or in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use, e.g.).	Atypical, but should be provided in any circumstance where adjacent land uses or facilities are likely to cause concentrations of pedestrians.

Table 5.4 Parkway Intersection Elements (continued)

Element:	Main Street	Avenue Approach to	Boulevard Approach to	Pkwy/Pkwy Intersection or
	Approach:	Parkway/Avenue Intersection:	Parkway/Boulevard	Parkway Approach to Other
			Intersection:	Intersection Types :
Traffic Calming	Not a valid intersec-	Consider a combination of	May be appropriate, if nec-	No.
	tion type.	elements on intersection	essary to maintain desired	
		approach to slow traffic ap-	speeds. Lateral shifts and	
		proaching intersection. At the	some forms of narrowing	
		intersection, curb extensions	may be considered. See	
		may be used, for example (see	CDOT's Traffic Calming	
		"curb extensions", above, and	Report for more informa-	
		CDOT's Traffic Calming Re-	tion.	
		port for more information).		

5.5 Local Street Intersections

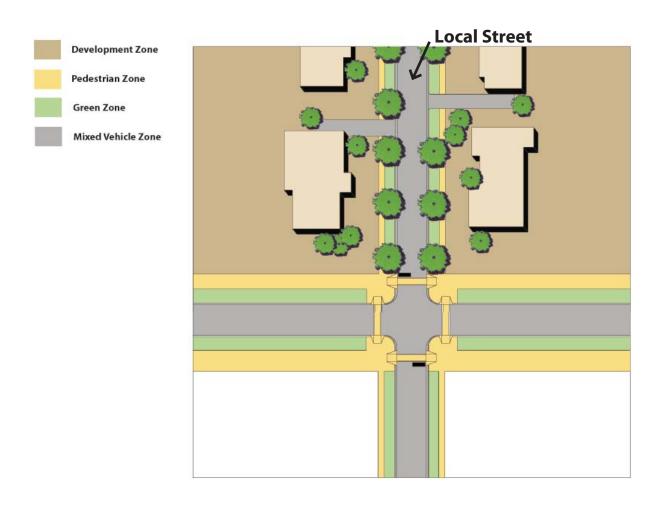
There are three different Local street types (residential, office/commercial, and industrial) and multiple cross-sections for two of those street types (residential and office/commercial). Any of these street types can intersect with any other street type. Intersections between two Local streets should be designed to reflect the primary function of Local streets - providing access to land uses. Intersections between Local streets and non-local streets should be designed to accommodate the lower volumes and modal balance of a Local street, balanced against the higher volumes and wide range of possible functions of the intersecting non-local street. The design recommendations for Local streets should be considered more prescriptive than those for non-local streets, particularly at Local/Local intersections.

Assumed Conditions:

- (1) Local streets provide access to specific (existing or planned) land uses. Traffic volumes and speeds on Local streets will be low.
- (2) Intersections of two Local streets should be designed to maintain low-speed, low-volume conditions similar to or lower than those for Main Streets.
- (3) Local streets and their intersections should be designed toward more of a pedestrian orientation than an autoorientation. This is less the case with local *industrial* streets, where higher volumes of truck traffic will require some design features that are not as pedestrian-oriented as those of other Local streets.

The following table provides guidance in applying design elements to different types of Local intersections. The column headings refer to the various possible types of approach legs. The "Local Approach" column should be used to assess all Local-to-Local intersections, as well as the Local approach to any of the other intersection types (Local-to-Main, Local-to-Avenue, Local-to-Boulevard, and Local-to-Parkway).

Local Street Intersections 5.5



Local Street Intersections

This example shows a Medium Residential Street intersection. For specific information on Local Street intersections, refer to the guidelines on Table 4.5.

Table 5.5 Local Street Intersection Elements

Element:	Local/Local Intersections or Local Approach to Other Intersections:	Main Street Approach to Local/Main Intersections:	Avenue Approach to Local/Avenue Intersections:	Boulevard Approach to Local/ Blvd Intersections:	Parkway Approach to Local/Parkway Intersections:			
Level of Service	Level of Service (LOS) at signalized intersections: Intersect							
Pedestrian LOSObjective	LOS A for the entire Local/Local intersection.	LOS A for the entire Local/Main intersec- tion.	LOS B for the entire Local/Avenue intersection.	LOS B for the entire Local/Boulevard intersection.	LOS D for the entire Local/Parkway intersection.			
Bicycle LOS Objective	Not applicable (see Appendix A for details).	Not applicable (see Appendix A for details).	LOS B for the entire Local/Avenue intersection, using the average LOS value of only the Avenue approaches (see Appendix A for details).	LOS B for the entire Local/Blvd inter- section, using the average LOS value of only the Blvd approaches (see Appendix A for details).	LOS C for the entire Local/Park-way intersection, using the average LOS value of only the Parkway approaches (see Appendix A for details).			
Motor Vehicle V/C Threshold	1.0, for two consecutive AM or PM hours, for the entire Local/Local intersection.	1.0, for two consecutive AM or PM hours, for the entire Local/Main intersection.	.95, for two consecutive AM or PM hours, for the entire Local/Avenue intersection.	.95, for BOTH one AM and one PM hour, for the entire Local/Blvd intersec- tion.	.90, for BOTH one AM and one PM hour, for the entire Local/Parkway intersection.			
Median	Atypical, but allowable under special circumstances, as an aesthetic or	Atypical, but allowable under special circumstances (see Chapter	Atypical. When provided, should be a minimum width	Should be provided, with a minimum width of 6' at the	Yes, preferably 9' wide at the intersection, 6'			

Local Street Intersection Elements (continued) Table 5.5

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
	gateway feature. When	4, Section 4.1). When	of 6' at intersec-	intersection (face-	minimum (face-
	provided, should be a	provided, should be a	tions (face-of-curb	of-curb to face-of-	of-curb to face-of-
	minimum width of 6' at	minimum width of 6'	to face-of-curb), for	curb), for pedestrian	curb), for pedes-
	intersections (measured	at intersections (face-	pedestrian refuge.	refuge.	trian refuge.
	face-of-curb to face-of-	of-curb to face-of-			
	curb), for pedestrian	curb), for pedestrian			
	refuge. Use mountable	refuge.			
	aprons at the intersec-				
	tion to allow tighter curb				
	radii. Avoid on Local				
	Industrial streets.				
Pedestrian	Atypical, but, where a	Atypical, but allowable	Consider when there	Should be provided,	Should be pro-
Refuge	median exists, a paved	at signalized intersec-	are 4 or more lanes	by extending the	vided, by extending
Island	portion may serve as	tions, if necessary	on the approach. To	median through	the median to the
	pedestrian refuge at	for traffic calming.	be provided either by	through the cross-	intersection. 9'
	the crosswalk, particu-	Where provided,	extending the median	walk. 6' minimum	preferred width,
	larly at intersections with	refuges should be a	to the crosswalk or by	width (measured	with 6' minimum
	higher volume Avenues	minimum of 6' wide	providing a separate,	face-of-curb to	(measured face-
	or Boulevards. Where	(measured face-of-	6' minim um, pedes-	face-of-curb); 8'	of-curb to face-of-
	provided, refuges should	curb to face-of-curb).	trian refuge (mea-	preferred if Local	curb). 8' minimum
	be a minimum of 6' wide		sured face-of-curb to	approaches have	if Local approaches
	(measured face-of-curb		face-of-curb).	land uses likely to	have

Table 5.5 Local Street Intersection Elements (continued)

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
	to face-of-curb).			generate pedestrian	land uses likely to
				traffic across the	generate pedestrian
				Boulevard ap-	traffic across the
				proaches.	Parkway approach-
					es.
Number of	No more than 1 in each	No more than 1 in	Typically, 1 to 2	Typically, 2 lanes in	2 to 3 lanes in each
Through Lanes	direction.	each direction.	lanes in each direc-	each direction.	direction.
			tion.		
Left-Turn	Atypical. Local street	Allowable only with	Will be provided	Should be provided	Should be pro-
Lane	entrances should not be	the 3-lane Main Street	with the 3-lane and	where there are	vided where there
	wider than 3 lanes total,	cross-section. Typi-	the 5-lane cross-	median openings or	are median open-
	with 2 lanes total pre-	cally, the turn lane will	sections. Allowable	left-overs, ideally 11'	ings or left-overs,
	ferred.	be 10' wide.	on 4 lane cross-sec-	wide. In constrained	ideally 11' wide.
			tion. 10' turn lanes	situations, may be	In constrained
			suitable.	10' wide.	conditions, may
					be a minimum of
					10' wide. Should
					preferably include
					a 4' offset and an
					edge line, if there
					is no curb on the
					median.

Local Street Intersection Elements (continued) Table 5.5

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
Dual	Inappropriate.	Inappropriate.	Typically inap-	Typically inap-	Inappropriate.
Left-Turn			propriate. May	propriate. May	
Lanes			be allowable onto	be allowable onto	
			"narrow" Local	"narrow" Local	
			Commercial streets,	Commercial streets,	
			which would be for	which would be for	
			access to campus-	access to campus-	
			style office park set-	style office park set-	
			tings. In that case, a	tings. In that case, a	
			short receiving lane	short receiving lane	
			leading into the site	leading into the site	
			would be provided	would be provided	
			if dual lefts off of a	if dual lefts off of a	
			busy thoroughfare	busy thoroughfare	
			are necessary. This	are necessary. This	
			solution should be	solution should be	
			applied only rarely.	applied only rarely.	
			Dual lefts are inap-	Dual lefts are inap-	
			propriate onto other	propriate onto other	
			Local streets.	Local streets.	

Table 5.5 Local Street Intersection Elements (continued)

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
Right-Turn	Atypical. Local street	Inappropriate.	Discouraged. The	Allowable. The	Although right-
Lanes	approaches should not be		preferred option is	preferred option is	turn lanes are the
	wider than 3 lanes total,		to provide additional	to provide additional	ideal on Parkways,
	with 2 lanes preferred.		connections in the	connections in the	they should be very
			surrounding street	surrounding street	carefully consid-
			network.	network.	ered and designed
					when they are
					allowing turns onto
					Local Streets. The
					design of these
					lanes should dis-
					courage continuous
					flow and, where
					used, Florida slip-
					lane design with
					corner islands is
					the preferred treat-
					ment.

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
Right-Turn	Not applicable.	Not applicable.	Inappropriate.	Allowable, if neces-	Yes, if used in
Corner				sary to maintain ac-	conjunction with
Islands				ceptable pedestrian	Florida slip-lane
				LOS with the addi-	design, as dis-
				tion of a right-turn	cussed above
				lane. Minimum of	under "Right-Turn
				50 sf, Florida Slip-	Lanes".
				Lane design pre-	
				ferred.	
Tapers	Inappropriate.	Inappropriate.	Inappropriate.	Typically inappro-	Typically inappro-
				priate, but allowable	priate, but allow-
				onto Local Indus-	able onto Local
				trial streets.	Industrial streets.
Bicycle	Not applicable.	Not applicable.	Should be provided.	Should be provided.	Typically inap-
Lanes			4' minimum. 5'	5' minimum. 6'	propriate, but may
			minimum and 6'	preferred. May also	be allowed, to
			preferred when on-	be provided on a	maintain bicycle
			street parking exists	parallel frontage	network connectiv-
			along the segment.	road, if that creates	ity (6' minimum).
				the safest cycling	Preferred option
				treatment.	is to have separate
					facility outside of

Element:	Local/Local Intersections or Local Approach to	Main Street Approach to Local/Main	Avenue Approach to Local/Avenue	Boulevard Approach to Local/	Parkway Approach to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
					right-of-way or on parallel local streets.
Curb	Should be considered	Should be provided,	7' extensions should	Inappropriate.	Inappropriate.
Extensions	at Local/Local intersections (except for Industrial streets), particularly where there is the likelihood of high pedestrian volumes (such as on "wide" Commercial or Residential streets) and/or the need for traffic calming (as on "medium" or "wide" Residential streets). Should be provided at intersections with Main Streets and are allowed at Avenues.	at same width as on- street parking (7'), except at far-side bus stops with high service frequencies.	be provided where full-time, on-street parking exists along the segment, except at far-side bus stops on 2-3 lane cross-sections.		

Element:	Local/Local Intersections or Local Approach to Other Intersections:	Main Street Approach to Local/Main Intersections:	Avenue Approach to Local/Avenue Intersections:	Boulevard Approach to Local/ Blvd Intersections:	Parkway Approach to Local/Parkway Intersections:
Bus Stops:	Allowable far side, near side, or mid-segment.	Typically located at far side of intersection.	Typically located at far side of intersection.	Typically located at far side of intersection.	Typically located at off-street lots or stops. Far side stops preferred at intersections.
• Pullout	Inappropriate in most circumstances, though might be considered at high volume bus stops on "narrow" Local Commercial streets.	No.	No.	Consider for high frequency bus stop locations.	Yes.
• Curb Extension	Typically unnecessary at bus stops, except as described above under the general topic of "curb extensions".	Not allowed at far-side stops with high service frequencies. May be considered at other stop locations.	Should be provided (at the same width as the on-street parking) where full-time, on-street parking exists. Do not use at far-side on the 2-3 lane cross-sections.	No.	No.

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
Curb Radii	The intent on these low-	The intent in these	The intent is to keep	The intent is to keep	The intent is to
	volume and low-speed	pedestrian-oriented	the curb radii as	the curb radii as	keep the curb radii
	streets is to keep the curb	areas is to keep the	small as possible.	small as possible.	as small as possible.
	radii small. See Appen-	curb radii small. See	See Appendix C,	See Appendix C,	See Appendix C,
	dix C, "Curb Radii" for	Appendix C, "Curb	"Curb Radii" for	"Curb Radii" for	"Curb Radii" for
	details.	Radii" for details.	details.	details.	details.
ADA Ramps:					
• Type 1	No.	No.	No.	No.	No.
• Type 2	Yes. See CDOT's Guide-	Yes. See CDOT's	Yes. See CDOT's	Yes. See CDOT's	Yes. See CDOT's
-/F · -	lines for the Design and	Guidelines for the	Guidelines for the	Guidelines for the	Guidelines for the
	Location of Accessible	Design and Loca-	Design and Location	Design and Location	Design and Loca-
	Ramps for details and	tion of Accessible	of Accessible Ramps	of Accessible Ramps	tion of Accessible
	explanations regarding	Ramps for details and	for details and ex-	for details and expla-	Ramps for details
	appropriate ramp designs	explanations regard-	planations regarding	nations regarding	and explanations
	under varying circum-	ing appropriate ramp	appropriate ramp	appropriate ramp	regarding appro-
	stances.	designs under varying	designs under vary-	designs under vary-	priate ramp designs
		circumstances.	ing circumstances.	ing circumstances.	under varying
					circumstances.

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
Crosswalks:	Should be provided on	Should be provided on	Should be provided	Should be provided	Should be provided
	all legs at signalized in-	all legs at signalized	on all legs at signal-	on all legs at signal-	on all legs at signal-
	tersections, unless there	intersections, unless	ized intersections,	ized intersections,	ized intersections,
	is a physical restriction	there is a physical	unless there is a	unless there is a	unless there is a
	or safety-related reason	restriction or safety-	physical restriction	physical restriction	physical restriction
	that requires otherwise.	related reason that	or safety-related	or safety-related	or safety-related
	Should also be provided	requires otherwise.	reason that requires	reason that requires	reason that re-
	on the Local legs of un-	Typically would not	otherwise. Typically	otherwise. Typically	quires otherwise.
	signalized intersections	provide on Main	would not provide	would not provide	Typically would
	with Non-Local streets.	Street approach to	on Avenue approach	on Blvd approach to	not provide on
	At Local/Local intersec-	unsignalized inter-	to unsignalized	unsignalized inter-	Parkway approach
	tions, crosswalks should	sections with Local	intersections with	sections with Local	to unsignalized
	be provided at locations	streets.	Local streets.	streets.	intersections with
	where there is likely to be				Local streets.
	a high level of pedestrian				
	activity.				
 Marked 	Yes, always using en-	Yes, always using	Yes, always using	Yes, always using	Yes, always using
	hanced marking or	enhanced marking or	enhanced marking	enhanced marking,	enhanced marking,
	enhanced paving.	enhanced paving.	or enhanced paving.	but not enhanced	but not enhanced
				paving.	paving.
• Location	Should not be located on	Should not be located	Should not be lo-	Should not be lo-	Should not be lo-
	the radius.	on the radius.	cated on the radius.	cated on the radius.	cated on the radius.

Element:	Local/Local Intersections or Local Approach to	Main Street Approach to Local/Main	Avenue Approach to Local/Avenue	Boulevard Approach to Local/	Parkway Approach to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
Traffic Control:					
• Two-Way Stop	Yes.	No.	No.	No.	No.
• Four-Way Stop	Yes, at other Locals and at Main Streets.	Yes, at other Locals and at Main Streets.	No.	No.	No.
• Round-about	Allowable at other Locals, Mains, and, in rare instances, at Avenues. Not at Boulevards or Parkways.	Allowable as a gateway transition.	Allowable for traffic calming when: 1) volumes are less than 35,000; 2) analysis shows that roundabouts provide higher vehicle LOS than signals; 3) provision of roundabout does not degrade pedestrian and bicycle LOS, and 4) movements are balanced enough to allow safe exit from the Local Street leg. Typically want to avoid multilane roundabouts at these intersections.	No.	No.

Element:	Local/Local Intersections or Local Approach to Other Intersections:	Main Street Approach to Local/Main Intersections:	Avenue Approach to Local/Avenue Intersections:	Boulevard Approach to Local/ Blvd Intersections:	Parkway Approach to Local/Parkway Intersections:
• Signals	Yes, depending on warrants, though unlikely at Local/Local intersections.	Yes, depending on warrants, with bus signal priority, where appropriate.	Yes, depending on warrants, with bus signal priority, where appropriate.	Allowable, depending on warrants, with bus signal priority, where appropriate.	Rarely.
• Right-Turn on Red	Allowable in rare case where a Local/Local intersection is signalized, but should be avoided in locations with a high potential for pedestrian traffic. Not allowed at Main Street intersections. Allowable at other intersections, but should be avoided in locations with a high potential for pedestrian traffic (in areas that are currently or are planned to be pedestrian-oriented retail or mixed use.	Not allowed.	Allowable, but should be avoided in locations with a high potential for pedestrian traffic (in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use).	Allowable, but should be avoided in locations with a high potential for pedestrian traffic (in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use).	Desirable if signalized, depending on sight distance and potential for higher volume pedestrian traffic at the intersection.

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
• Pedestrian	Yes, where signal war-	Yes, with countdown.	Yes, with count-	Yes, with count-	Yes, with count-
Signals	rants are met, with	Also consider au-	down. Also con-	down. Also con-	down. Also
	countdown. Also con-	dible signals (where	sider audible signals	sider audible signals	consider audible
	sider audible signals	deemed appropriate)	(where deemed	(where deemed	signals (where
	(where deemed appropri-	and leading pedestrian	appropriate) and	appropriate) and	deemed appropri-
	ate) and leading pedes-	interval.	leading pedestrian	leading pedestrian	ate).
	trian interval.		interval.	interval.	
Bicycle	Provide for all Local	Provide for all Main	Provide for through	Provide for left	Typically, not ap-
Detectors	Street approaches to sig-	Street approaches to	lanes and left turns.	turns.	plicable. Bicycle
	nalized intersections.	signalized intersec-			facilities should
		tions.			be provided as far
					as possible from
					the travel lanes on
					Parkways.
Advance	Yes, at signalized in-	Yes, at signalized	Yes. Should be	Yes. Should be	Allowable. Should
Stop Bars	tersections. Should be	intersections. Should	spaced to allow clear	spaced to allow clear	be spaced to allow
	spaced to allow clear	be spaced to allow	separation and vis-	separation and vis-	clear separation
	separation and visibility	clear separation and	ibility between cars	ibility between cars	and visibility be-
	between cars and the	visibility between cars	and the crosswalk	and the crosswalk.	tween cars and the
	crosswalk and, where	and the crosswalk and,	and, where neces-	Stagger the stop bars	crosswalk. Stagger
	necessary, far enough	where necessary, far	sary, far enough	when right-turn on	the stop bars when
	back to allow for vehicles	enough back to allow	back to allow for	red is allowed. This	right turn on red

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
	turning off of the cross	for vehicles turning off	vehicles turning off	allows the turning	is allowed. This
	street.	of the Local Street.	of the other street.	vehicle to observe	allows the turning
			With the four-lane	approaching traffic	vehicle to observe
			cross-section, stag-	without encroaching	approaching traffic
			ger the stop bars	into the crosswalk.	without encroach-
			when right-turn on		ing into the cross-
			red is allowed. This		walk.
			allows the turning		
			vehicle to observe		
			approaching traffic		
			without encroaching		
			into the crosswalk.		
Bike Box	Inapplicable, since bikes	Inapplicable, since	Should be consid-	Should be consid-	No. If a bike lane
Direction	are expected to travel in	bikes are expected to	ered, but only if a	ered, but only if a	exists, use bicycle
	mixed traffic.	travel in mixed traffic.	bike lane approaches	bike lane approaches	stop bars, rather
			the intersection.	the intersection.	than a bike box.
			This bike lane ap-	This bike lane ap-	
			proach need not run	proach need not run	
			the entire length of	the entire length of	
			the segment.	the segment.	

• Bicycle Stop Bars	Local/Local Intersections or Local Approach to Other Intersections: Inapplicable, since bikes are expected to travel in mixed traffic.	Main Street Approach to Local/Main Intersections: Inapplicable, since bikes are expected to travel in mixed traffic.	Avenue Approach to Local/Avenue Intersections: Should be provided if there is a bike lane, but no bike box.	Boulevard Approach to Local/ Blvd Intersections: Should be provided if there is a bike lane, but no bike box.	Parkway Approach to Local/Parkway Intersections: Provide in the rare circumstance that a bike lane exists.
• Grade Separation	No.	No.	No.	No.	No.
• Street	Yes.	Yes.	Yes.	Yes.	Yes.
• Pedestrian	Should be provided where adjacent land uses or facilities are likely to cause concentrations of pedestrians (at bus stops or in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use, e.g.).	Yes.	Should be provided where adjacent land uses or facilities are likely to cause concentrations of pedestrians (at bus stops or in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use, e.g.).	Should be provided where adjacent land uses or facilities are likely to cause concentrations of pedestrians (at bus stops or in areas that are currently or are planned to be pedestrian-oriented retail or mixed-use, e.g.).	Atypical, but should be provided in any circumstance where adjacent land uses or facilities are likely to cause concentrations of pedestrians.

Element:	Local/Local Intersections	Main Street Approach	Avenue Approach to	Boulevard	Parkway Approach
	or Local Approach to	to Local/Main	Local/Avenue	Approach to Local/	to Local/Parkway
	Other Intersections:	Intersections:	Intersections:	Blvd Intersections:	Intersections:
Traffic	Slow points should be	Typically not neces-	Consider a combi-	May be appropri-	No.
Calming	provided on Local streets	sary, but may be used	nation of elements	ate, if necessary	
	every 300-500 feet. Stops	to maintain desired	on intersection	to maintain de-	
	at intersections can count	speeds.	approach to slow	sired speeds. Lat-	
	as slow points. Curb		traffic approaching	eral shifts and some	
	extensions and other de-		intersection. At the	forms of narrowing	
	vices can also narrow the		intersection, curb	may be considered.	
	intersection and serve		extensions may be	See CDOT's Traffic	
	to calm traffic (see "curb		used, for example	Calming Report for	
	extensions", above, and		(see "curb exten-	more information.	
	CDOT's Traffic Calming		sions", above, and		
	Report for more infor-		CDOT's Traffic		
	mation)		Calming Report for		
			more information).		