2. DESIGNING STREETS FOR MULTIPLE USERS

These Urban Street Design Guidelines are intended to ensure that the best aspects of Charlotte's transportation network are re-created as the City and its street network continue to evolve. This means that the various street design elements (described in Chapters 4 and 5) must be applied in the right mixes and in the right places. The process for planning and designing streets must also be sensitive to both the land use context and to the needs of the various users of a street. This chapter provides information about how different travelers may expect different things from a street. Equally important, the following chapter (Chapter 3) describes a method for applying the Guidelines so that any tradeoffs are evaluated fairly for all stakeholders.

Assessing Tradeoffs: Who is Using the Street?

The first step towards designing streets that provide viable transportation options is to understand that different users of the street will likely have different expectations of what makes a "good" street. A street design solution that works well for a motorist, for example, may or may not work well for a pedestrian or a bicyclist. This is one reason many American cities are becoming more concerned about providing "complete streets." Further, even if every "ideal" design element for all of the *travelers* on a street were provided, then the resulting street might not satisfy the expectations of the people who live or work along it. These different stakeholders and their expectations for a street can complicate the design process, which is one reason Charlotte has developed these Guidelines.

Prior to the 1990s, street design was treated as a relatively straightforward task, with a pre-set menu of (often auto-oriented) cross-sections for streets with pre-defined functional classifications. That approach is changing in many cities, for a variety of reasons. One reason is that right-of-way becomes constrained as cities develop, and "standard" cross-sections are less likely to fit within the available right-of-way, particularly for retrofit projects. Another reason is that there is increasing concern about providing facilities that can be used by people other than motorists. In these cases, designing the street has had to become a more analytic process - one that considers the various user perspectives and the surrounding land use context, *in addition to* the street function.

These Guidelines are intended to ensure a process that clearly, consistently, and comprehensively considers the needs of motorists, pedestrians, and bicyclists when planning and designing streets. All streets should be evaluated in terms of how they affect many different groups, including:

- motorists,
- pedestrians (including transit riders),
- transit operators,
- bicyclists, and
- people living, working, or otherwise using the adjacent land uses.

Each of these groups has expectations about how a given street should function and, therefore, how it should be designed. The following examples describe various street users' perspectives and how they might be addressed in the design process.

What Do Motorists Want From Streets?

When a motorist expresses a concern or makes a request related to streets, it often stems from congestion or safety concerns. Motorists might expect streets to be widened and signalized intersections to be timed to enhance their own travel times, for example. They may also ask that the number of stop-controlled intersections on local streets be reduced, so that they can maintain free flow through neighborhoods. This interest in design features that motorists feel provide them "safe and efficient" travel has also long been the primary concern of highway designers.

To meet motorists' expectations for safe and efficient travel, perfect conditions over the street network would include:

- minimal travel delays,
- minimal conflicts (affecting both delay and safety), and
- consistently designed facilities.

For the most part, though, urban streets cannot provide this combination of conditions except perhaps on freeways or other access-controlled roadways. Even then, travel delay and potential for conflicts with other vehicles will vary by time of day. Furthermore, consistent design is not only difficult to provide on urban streets, but probably not even desirable for other reasons (it is at odds with the concept of context-sensitive design).

Although providing all of the favorable conditions for motorists described above is difficult, there are ways to achieve some of the motorists' preferences, either through construction or operational changes. These approaches include:

- adding through or turn lanes to increase capacity, which can help reduce delay, at least temporarily;
- making operational changes, such as providing more green-signal time to the street with the higher traffic volumes, which can reduce the wait time at signalized intersections *for those motorists on the higher volume street* while increasing the wait time for motorists entering from the lower volume side street;
- constructing grade-separated intersections and roundabouts, rather than signal or stop controlled intersections, which can also limit delay and increase capacity; and
- using bus pullouts to separate stopping transit vehicles from the travel lane and, therefore, to help reduce delay.

A roundabout can slow traffic without making the motorist actually stop.

Motorists not only want to travel quickly, but they also want to arrive safely. A variety of design features have been used through the years to enhance motorists' safety. For example:

- wide travel lanes are generally considered more forgiving to the motorist than are narrow travel lanes;
- turn lanes separate turning vehicles from the through traffic, potentially reducing rear-end collisions;
- medians separate opposing traffic streams;
- greater sight distances generally improve a motorist's ability to "see and be seen", thereby providing greater opportunity to avoid collisions;
- street lighting improves overall visibility; and
- a clear zone adjacent to the outside travel lane provides an extra measure of "forgiveness", should a vehicle actually leave the travel lanes.

In addition to these traditional, auto-oriented engineering designs, there are also design features that are desirable for other travelers, but which also have safety benefits for motorists. For example, bike lanes and planting strips, which buffer

A median can increase motorist safety and provide a refuge for pedestrians. However, it might also encourage higher speeds than desired.

pedestrians from traffic, also improve motorists' safety by increasing sight distance and by reducing the potential for conflicts between autos, bicycles, and pedestrians. Minimizing conflicts provides the motorist potential travel time savings and increased safety. Many of the "safety features" described on the previous page are, in fact, ways to minimize conflicts for the motorist.

As described, there are many ways to meet motorists' expectations for safe and efficient travel. However, doing so can have unintended and paradoxical results - many of the design elements listed above also tend to encourage higher speeds, thereby potentially *reducing the safety of not only motorists, but also bicyclists and pedestrians.* Design features that can encourage higher speeds include:

- wide travel lanes (particularly if the overall street cross-section is wide),
- a large clear zone (including a lack of street trees),
- medians,
- large (wide) curb radii at intersections and driveways, and
- straight, flat sections of streets with long blocks and widely spaced intersections.

Some drivers drive fast to reduce their travel times. Some drivers simply like to drive fast. Besides the safety paradox just described, this "need for speed" usually translates into rapid acceleration and deceleration between intersections, often with minimal impact on a driver's total travel time, but with significant impacts on pedestrians, bicyclists, and others using the street. These types of interrelationships and tradeoffs need to be considered when attempting to address motorists' expectations, particularly if that involves physical changes to streets and intersections.

What Do Pedestrians Want From Streets?

A traditional approach to street design might define pedestrian needs as simply 1) a sidewalk and 2) the ability to safely cross the street. These are, indeed, crucial to creating a safe walking environment. However, pedestrians expect and need more than just "walking space" to feel safe and comfortable, and these Guidelines consider many factors as important to pedestrians. If we are to support and encourage walking as an attractive and viable travel mode, our street designs should reflect that pedestrians also value features that:

- help shorten walking distances,
- separate (or buffer) pedestrians from moving traffic,
- create aesthetically pleasing surroundings and amenities,
- protect pedestrians from the elements, and
- let them walk as safely as possible.

In addition, some special pedestrian populations may have other, specific concerns and their needs must also be considered. For example, safe crossings for blind pedestrians may require a different set of design features than those for pedestrians in general.

Many individual design elements can provide for any one of the general

categories of pedestrian expectations described above. However, effectively encouraging more pedestrian travel typically requires a combination of several design elements, since the pedestrian is reacting to the overall walking environment. For example, the combination of

Many design elements combine to make this a functional pedestrian environment.

safe crossings, security lighting, and wide sidewalks may not encourage walking if people feel *they have nowhere to walk to.* For walking trips other than for pure recreation, this means that a walkable environment includes a mix of land uses in close enough proximity to walk comfortably between them.

People are much more likely to walk to a given destination if walking distance is minimized or if they perceive that the distances are not too long. In business districts, for example, typical acceptable walking distances may be longer than in an office park, since people are more likely to have stores, windows, and ground floor features to look at while they're walking in the business district. Conversely, walking in an office park often means traversing large parking lots with little visual stimulation, all of which makes the walk seem longer. Perceived distance, therefore, can be influenced by providing the right types of land uses and design characteristics. Distance can also be minimized by creating direct connections between land uses. Design elements that create better connections include:

- short blocks with marked intersections,
- safe mid-block crossings on longer blocks, and
- continuous walkway systems that connect door fronts with transit stops or other destinations.

Buffering pedestrians from passing cars also increases their comfort, even if they already have their own "walking space". Pedestrians generally find sidewalks with some sort of buffer more attractive than sidewalks built right next to moving traf-

fic. Several design elements can help to create suitable buffers between pedestrians and traffic, including:

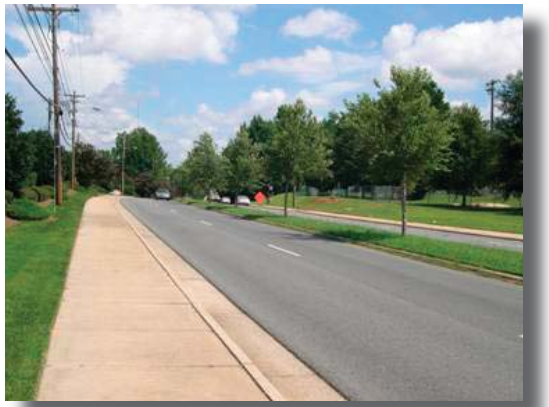
- planting strips,
- bicycle lanes,
- landscaping, and
- on-street parking.

These elements may be used alone or in combination. The dimensions of any one of these elements might vary, depending on how and whether it is combined with others. For example, an 8' planting strip will allow large maturing trees, which creates two types of buffer. That type of additional buffering is particularly important on a high-speed, high-volume street. By the same token, a 4' planting strip will still allow landscaping, but might require some additional form of buffering to increase the comfort level, even for those traveling on a lower-volume street. In that case, a bike lane or designated on-street parking could provide the extra buffer. The "correct" combination of these elements will depend on the space available, the various stakeholders' expectations, the land use context, and the objectives for the street.

The planting strip and trees combine for both vertical and horizontal buffering between pedestrians and motor vehicles.

Security is also an important consideration, since pedestrians will feel more vulnerable than motorists in many circumstances. A pedestrian's sense of security is improved by:

- providing street lighting and pedestrian scale lighting, and
- increasing pedestrian visibility from adjacent land uses (by placing windows/doors/"eyes on the street").



This "back-of-curb" sidewalk provides no buffer between pedestrians and vehicles.

Urban design can go a long way toward enhancing or hurting a pedestrian's sense of security - blank walls and facades, lack of windows and doors facing onto the street, and very large setbacks, for example, will isolate pedestrians from other activities and people.

Personal safety is also affected by the numbers and types of traffic conflicts to which pedestrians are exposed. The number of conflicts faced by a pedestrian can be reduced by:

- managing driveway access to minimize and control the locations of turning cars, and
- providing median or corner pedestrian refuge islands, which help to break up a crossing into more easily manageable parts.

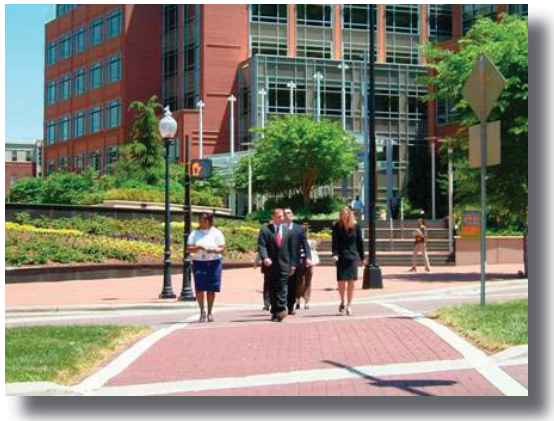
This route would not seem secure to most pedestrians.

These design elements basically allow a pedestrian to only have to consider the various traffic movements one at a time. The overall distance (or time) over which the pedestrian must deal with potential conflicts can also be minimized by:

- reducing the number of travel lanes,
- providing curb extensions,
- designing smaller curb radii, and
- providing sufficient signal timing so that pedestrians do not feel "trapped" in an intersection.

In a less obvious fashion, a robust street network, with many connections, can make it easier to provide the pedestrian-friendly design treatments just described. **For a thorough discussion of how various intersection design elements, in combination, affect pedestrians at signalized intersections, see Appendix B.**

Conflicts between pedestrians and vehicles are not limited to motor vehicles,



The design elements on this route enhance the perception of personal safety and security.

but also occur with bicycles. Cyclists traveling the wrong way in mixed traffic or on the sidewalk are particularly dangerous, because they are traveling faster than pedestrians, but they are less visible and make less noise than motor vehicles. That is why bike lanes serve an important function for pedestrians that goes above and beyond the extra buffering described earlier.

A daunting intersection, from a pedestrian's perspective.

Aesthetics can also have a major impact on enhancing pedestrian comfort. Streetscape elements that impact aesthetics include:

- pedestrian scale lighting,
- benches,
- trash receptacles,
- landscaping,
- urban design treatments for adjacent development, and
- walking surface texture.

These design treatments can enhance aesthetics, but are also important functional elements. For example, trees and other forms of landscaping are not just "pretty" to look at, but also provide shade and buffering. Likewise, awnings along major pedestrian routes provide shade and shelter to make the walking environment more comfortable.

What Does Transit Want From Streets?

The "transit perspective" really needs to be discussed in terms of two different types of perspectives – that of the transit driver and that of the transit rider. Transit drivers are generally interested in and prefer the same street design elements as those who drive other large vehicles. Transit riders are essentially pedestrians, but pedestrians who are also interested in the placement and/or design features of bus stops and shelters. The street design team should consider both to help ensure transit's viability as an attractive mode of transportation.

Transit drivers have expectations specific to their need to operate very large vehicles along sometimes very busy streets. Transit drivers basically want:

- enough space to operate and maneuver their vehicles,
- minimal conflicts with other

travelers and with features along the sides of the street, and
- minimal delays, to help keep their route operating on time.

Design elements that help provide the space for buses to operate include:

- wide travel lanes,
- wide corner turning radii,
- street signs, utility poles, and on-street parking located to maximize clearance for side mirrors, and
- adequate merging distances.

Transit drivers also want to reduce the potential for conflict between transit vehicles and other travelers. In addition to minimizing driver fatigue, reducing such conflicts can also help minimize schedule delays, which harm transit operations and performance. Conflicts can be minimized by:

- selecting safe locations for bus stops, and
- providing signal priority for transit vehicles.

Just as delay will affect transit operations, so can the ability to provide more route coverage and travel efficiency. Coverage and efficiency are impacted by the extent of the street network. Short blocks providing multiple route options can increase pedestrians' access to transit as well as transit's access to more land uses (and potential riders).

Transit riders have the same types of interests as do other pedestrians, with some additional, specific expectations. Transit riders also want:

- accessible bus stops,
- easy connections, and
- personal comfort and security while waiting for the bus.

Generally speaking, accessibility comes from having well-located transit stops on a well-connected network. The spacing

of bus stops and their locations relative to pedestrian-oriented or clustered land uses will affect peoples' ability or willingness to use transit. Transit stops should be located so that walk distances are not excessive. In addition, those land uses located near transit stops should be designed with entrances and sidewalks connecting buildings directly to the stop or to the nearest public sidewalk.

Accessibility is further improved by having a dense, well-connected network for pedestrians. Such a network can be achieved by including short blocks on the street network or bike-pedestrian

A pedestrian connection between a neighborhood street and a thoroughfare enhances pedestrians' route options.

pathways. Either way, the connections should include paved surfaces. The unpaved pedestrian path that might be adequate for joggers will be inadequate for commuters using transit, for example.

Closely related to their need for accessibility, transit riders also want to be able to change modes as easily as possible. Intermodal accessibility is provided through an extensive pedestrian sidewalk network with easy street crossings (defined earlier for all pedestrians), direct vehicle connections to park and ride facilities, and bike racks at stations and bus stops.

Unlike most other pedestrians, transit riders must occasionally be stationary. At transit stops, transit riders will be concerned about their own comfort and personal security. Riders' security concerns may be more pronounced than those of other pedestrians, because transit riders may perceive that they are more vulnerable once they stop walking and start waiting. Perceived or actual security can be enhanced by a variety of design features, including:

- street and pedestrian-scale lighting.
- transit stop locations that are not isolated from land uses and other people, and
- increased visibility through urban design (windows and doorways that face onto the street, for example).

Basic comfort for waiting riders can be achieved by buffering them from through traffic lanes (see "pedestrian needs" for a list of elements that achieve this), and by transit shelters, bus pads, benches, trashcans, and other amenities.

Here, amenities from a bygone era have been updated.

Finally, some design elements have positive impacts on both the transit driver and the rider, while others can have unintended negative consequences for one or the other of these two groups. For example, the quality of the vehicle ride

A transit shelter located on Randolph Road.

affects both drivers and riders. The ride quality can be improved by minimizing vertical grade variations along curb lanes at cross-streets and drainage grate areas, and by providing smooth, well-maintained street surfaces. Conversely, the wider lanes and curb radii that provide more maneuvering space for the transit vehicles can create less comfortable streets for transit riders. Bus pullouts may *reduce* delays to motorists who would otherwise have to wait behind the stopped bus, but may *cause* delays for transit riders when the driver has to wait for a gap in traffic to merge back into the travel lane. The point is that there are tradeoffs inherent in many of the decisions that must be made as part of the street design process – and what works well for one type of traveler may or may not work well for another type of traveler.

What Do Bicyclists Want From Streets?

Different types of bicyclists have different perspectives or expectations related to their trips. Those expectations will vary according to the type of cyclist and the type of trip - experienced vs. casual cyclists and transportation vs. recreational trips. Experienced cyclists typically feel more comfortable traveling in the traffic lanes than do casual cyclists. Casual cyclists will often avoid mixing with traffic and will feel more secure riding in separate, dedicated bike lanes. Experienced cyclists who are commuting to work will typically take the shortest, most direct route, while recreational cyclists and/or less experienced cyclists may seek out indirect routes, either to enhance their recreational experience or because they are avoiding higher-volume, higher-speed streets.

Either way, bicyclists of all kinds generally want:

- a well-connected network of bicycling facilities,
- safe travel routes, and
- direct travel routes, particularly when bicycling for purposes other than strictly exercise or recreation.

A dedicated bicycle network that connects neighborhoods, schools, parks, and other activity centers must be developed for bicycling to become a viable travel mode in Charlotte. That bicycle network should include direct routes, multiple

Dedicated space for bicyclists is one way to create a good bicycle network on higher speed, high volume streets.

route options, and dedicated cycling space. Direct routes can be provided through both a continuous network of local streets and through bike lanes on higher-volume streets. Short blocks help to create the dense network necessary for direct routes and lower-volume route options. Signed bike routes and other wayfinding treatments can make it easier for casual cyclists to travel on the local street network for short trips that might otherwise be made by car.

On higher-volume, higher-speed streets, a bike lane is necessary for cyclists' safety and comfort. The width of the bike lane is very important:

- the minimum width for a designated bike lane is 4' of usable asphalt surface, with 5' preferred;
- where the bike lane is next to parked cars or on steep, uphill grades, 6' may be necessary, since the cyclist may need room to avoid opening car doors or to pedal uphill (which can cause "wobbling").

In cases where space is insufficient for an official bike lane, edge striping should be used to keep motor vehicles within 10' of the center line or next travel lane.

Cyclists also need to be visible to motorized traffic. There are a variety of design elements that help improve bicyclists' visibility, including:

Signed bike routes on the local street network also contribute to a good bicycle network.

- designated bike lanes,
- pavement markings,
- street lighting,
- bike boxes and bike signals at intersections, and
- buffers from travel lanes and parked cars.

Conflicts with cars, buses, and pedestrians can also be minimized through reducing driveway frequency in commercial areas and providing bike lanes.

For bicyclists to operate their vehicles safely, they also need smooth, continuous surfaces. These surfaces are affected both by paving and by drainage grate design and/or maintenance. Grates should never run parallel to the direction of travel and pavement markings should be carefully assessed for potential slickness.

These images show the importance of well-designed drainage grates.

Bicyclists have special types of problems traveling through intersections, since they must operate their bikes as vehicles, but they are smaller and more vulnerable than the other vehicles. At intersections, it is particularly important that bicyclists be visible to both motorists and pedestrians. Design elements that improve cyclists' visibility at intersections include:

- bike lanes that are located appropriately in relation to the vehicle turn lanes,
- lead signal indicators (which provide a headstart and allow bicycles to clear the intersection ahead of motor vehicle traffic),
- bicycle stop bars (which provide similar advantages as the lead signal indicators), and
- bike boxes, which require a bike lane leading to the intersection (see photo).

A bike box at an intersection.

Roundabouts allow vehicles, including bicycles, to continue moving, although at reduced speeds.

Bicyclists also benefit from any design element that allows them to avoid stopping or that reduces their delay once they do stop. Cyclists generally want to avoid stopping, since starting back up is not easy, particularly if it must be done quickly and in mixed traffic. Reducing delay can be achieved by the use of roundabouts, lead signal indicators, and bike sensitive signal detectors. **For a thorough discussion of signalized intersection features and their effects on cyclists, see Appendix B.**

What Do the Adjacent Land Uses Want From Streets?

Thus far, the discussion has focused on those who travel along streets, but these are not the only stakeholders who have an interest in streets. Other people who have an interest in how streets are designed include residents, business owners, property managers, employees,

and other occupants of buildings along a street or in adjacent neighborhoods. These types of stakeholders often consider themselves most impacted by designs or design changes intended to meet the needs of other stakeholders, particularly those of motorists. These "stationary" stakeholders' perspectives are an important consideration when deciding which street design elements should be included.

People who occupy neighboring land uses may have different perspectives on street design, depending on whether these are residential or commercial land uses. Either way, these stakeholders will all want to feel safe and secure, to have access to their property, and to enjoy an aesthetically pleasing environment. Therefore, they will likely see the following design elements as beneficial:

- lighting,
- safe and contained travelways,
- driveways (for access to their properties), and
- trees and landscaping.

These stakeholders will typically not want to lose portions of their property, so minimizing the overall right-of-way width may be seen as beneficial to most of these stakeholders, as well.

Owners, inhabitants, or managers of residential, institutional, commercial or any pedestrian-oriented properties typically are very concerned about safety. These stakeholders want slower traffic speeds and, in some cases, lower traffic volumes. The types of street design elements that can help achieve this include:

- traffic calming devices,
- low design speeds,
- safe and convenient pedestrian crossings, and
- reduced street widths.

A "choker" on a local street.

Speed tables or "humps" are widely used for traffic calming.

In residential and institutional zones, reducing the noise from motor vehicles may also be important. Some forms of traffic calming can help achieve some level of noise reduction, but for major thoroughfares, the best way to achieve this may be to provide more separation between apartments or condominiums and the travel lanes. People who live or work in residential or institutional zones may also express concern about pedestrian and/or bicycle pathways located "too close" to their properties, due to (typically unsubstantiated) security concerns.

Owners or operators of commercial uses, particularly lower-density, less pedestrian-oriented commercial uses, will want automobile access and visibility. Therefore, these stakeholders might:

- oppose access controls (limiting-driveways), and
- oppose medians, but
- want turn lanes, and
- want median breaks allowing access to their commercial properties.

In addition to automobile access, owners or operators of higher-density commercial uses are also interested in good access to pedestrian traffic. To achieve this, good site design will typically include:

- operating front doors and windows,
- direct sidewalks to the street,
- sidewalks between buildings, and
- sidewalks to parking areas.

To further improve access to both pedestrians and to those in automobiles, these land uses may also require:

A wide amenity zone is useful in pedestrian-oriented developments.

- wider sidewalks (8' minimum in high activity areas),
- sidewalk amenity zones,
- higher quality street furnishings, and
- on-street parking.

These land uses also can benefit from access to transit riders and bicyclists. Even so, property owners or managers may express concern about the appropriate locations and maintenance of bus stops and bike racks, if they feel that these design elements are unsightly or are blocking their building entrances.

A wide sidewalk, awnings and pedestrian-scale lighting enhance the pedestrian environment. The planting strip provides a buffer from traffic, since on-street parking is not feasible.

Assessing Tradeoffs: Complementary and Competing Stakeholder Perspectives

Clearly, some design elements will be deemed beneficial to all adjacent "neighbors" and even to the various types of travelers along the street. Sidewalks, bike lanes, and planting strips may fall into this category, for example. More often than not, however, different stakeholders will express different interests or perspectives related to "good" street design. This means that some design elements will benefit some users more than others and that some design elements that benefit one user group may actually work to the detriment of other users. That, along with the likelihood of right-of-way constraints, heightens the need to thoroughly assess tradeoffs between different perspectives during the design process.

Chapter 3 describes a process for planning and designing streets that incorporates an assessment of those tradeoffs. The matrix shown in Figure 2.1 (beginning on page 30) offers additional information for assessing tradeoffs among street design elements that various stakeholders may prefer. The matrix shows which design elements may enhance certain stakeholders' experiences and relates those design elements to other stakeholders' expectations. **The matrix is not intended to be a comprehensive treatment of all aspects of street design and the tradeoffs inherent in them. Rather, it offers examples that a design team can consider to solve a variety of design issues in constrained environments. The design team should use this matrix to help document their discussions of the decisions made during Step 6 of the design process described in Chapter 3. For intersection projects, the design team should follow the guidelines described in Chapter 5 and Appendices A and B for assessing level-of-service (LOS) for pedestrians and bicyclists for different intersection types.**

Note that the matrix treats "transit" from the Transit Drivers' perspective. since riders share the characteristics and expectations discussed for other pedestrians.

Figure 2:1

Design Element Matrix – Different User Perspectives

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Pedestrians Want Buffering from Cars						
Consider some mix of the following elements to create a buffer:						
Planting Strip	The wider the better, since wider strips allow trees to grow	◆	◆	◆	◇	◆
Amenity Zone	Use where high pedestrian volumes are likely, particularly in combination with on-street parking	◆	◇	◆	◆	◆
Wide Sidewalk	Back-of-curb (6' min.) may be allowable in retrofits, if combined with bike lane or on-street parking	◆	◇	◇	◇	◆
Bike Lanes	Provide "extra" buffering, in combination with other elements	◆	◆	◆	◆	◆
On-Street Parking	Helps shield pedestrians from moving traffic	◆	◆	◆	◆	◆
Trees	Need a 6'-8' minimum planting strip or treewells in amenity zone; 8' is the minimum for large maturing trees	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Pedestrians Want Safe and Comfortable Walkways						
The following elements impact pedestrians' comfort and safety:						
Adequate Sidewalk Width	5' is minimal width for two people to pass comfortably; ADA also supports 5' minimum; in higher volume locations, provide wider sidewalks	◆	◇	◇	◇	◆
Solid Surfaces	Minimize grates and other uneven surfaces	◆	◇	◇	◆	◆
No Sidewalk Obstructions	Utility poles and street furnishings should never be in the sidewalk; sidewalk width should be unobstructed	◆	◇	◇	◇	◇
Few Driveways	Reduce potential conflicts between pedestrians and turning vehicles; particularly important in Main Street settings or on "commercial/ retail" blocks	◆	◆	◆	◆	◆
Vertical Curbs	Separate the vehicle zone from pedestrian zone; mountable (valley) curbs increase the likelihood that cars will park on all or a portion of the sidewalk	◆	◆	◇	◇	◇

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2:1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Pedestrians Want Personal Security						
Consider the following elements to reduce pedestrians' vulnerability:						
Pedestrian Scale Lighting	More than just aesthetics, this identifies a "pedestrian area" and can fill gaps between street lights	◆	◆	◆	◆	◆
Street Lighting	If pedestrian scale lighting not provided, this becomes more important	◆	◆	◆	◆	◆
Other Pedestrians	Having other pedestrians around increases the number of "eyes on the street"; not a design element, but good streets and the right land uses tend to encourage more pedestrians	◆	◆	◇	◇	◆
Buildings Oriented onto Street	Must include windows and doors facing street for more "eyes on the street"	◆	◆	◆	◆	◆
Planting Strip	Provides extra separation between pedestrians and cars	◆	◆	◆	◇	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Pedestrians Want Aesthetics and "Things to Look At"						
The following are examples of ways to enhance the walking environment; they also can help with security issues:						
Trees and Landscaping	Provide a more attractive walking environment; 8' minimum planting strip for large maturing trees	◆	◆	◆	◇	◆
Street Furnishings (not blocking sidewalk)	Benches, fountains, kiosks, etc. reduce monotony, as well as serving specific functions	◆	◆	◇	◆	◇
Buildings Oriented onto Street	Reduce the "blank wall" effect and provide stopping opportunities	◆	◆	◇	◆	◇
Variable Building Facades	Reduce the "blank wall" effect	◆	◆	◇	◇	◇
Ground Floor Activity	Arrange buildings to encourage a high level of activity for the pedestrian to observe or participate in; also enhances security	◆	◆	◇	◇	◇

◆ - Positive Impact ◆ - Negative Impact ◇- Mixed Impact or Use With Caution ◇- Neutral

Figure 2:1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Pedestrians Want Protection from the Elements						
The following can provide some protection against the elements:						
Trees	Can serve as windbreak, if evergreen; deciduous trees provide shade in summer. Must have 8' minimum planting strip for large maturing trees	◆	◆	◆	◇	◆
Awnings	Clusters of awnings can combine with trees to create shade, as well as opportunities for shelter	◆	◇	◇	◇	◆
Bus Shelters	Provide pedestrians opportunities for shelter	◆	◇	◇	◆	◇
Arcades	Ground floor "promenades" can create a totally sheltered outdoor area	◆	◇	◇	◇	◆
Pedestrians Want Direct Connections						
The following can provide more direct connections and potentially shorter routes, which is particularly important for pedestrians:						
Complementary Land Uses	Providing more pockets of complementary uses makes walking more likely for more people	◆	◆	◆	◆	◇

◆ - Positive Impact ◆ - Negative Impact ◇ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

			Pedestrians	Cyclists	Motorists	Transit*	Neighbors
	Short Blocks	Provide more route options, shorter routes, and more opportunities for safe crossings	◆	◆	◆	◆	◆
	Mid-Block Crossings	Where blocks are very long, people need safer crossings between signals; must be appropriately applied - shorter blocks are generally preferable	◆	◆	◆	◆	◆
	Pedestrians Want Safer Crossings						
	Safer crossings can be achieved through combinations of the following: (See also CDOT's Pedestrian LOS in Appendix B and Mid-Block Crossing Policies for a more comprehensive discussion)						
	Mid-Block Crossings	Must be carefully applied to be safe; should be combined with other features	◆	◆	◆	◆	◆
	Refuge Islands	Should be 6' minimum to provide sufficient space and separation from traffic lanes	◆	◆	◆	◆	◆
	Medians	Provide a pedestrian refuge, if wide enough; consider hardscape at likely crossing spot; may also increase vehicle speeds, though	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2:1
Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Curb Extensions	Reduce crossing distances and may also serve to reduce vehicular speeds	◆	◆	◆	◆	◆
Pedestrian Countdown Signals	Let pedestrians know how much "crossing time" is available; use in combination with enhanced crosswalks and other features	◆	◇	◆	◇	◇
Neckdowns or Street Narrowing	The less pavement to cross at one time, the better	◆	◆	◆	◆	◆
Small Curb Radii at Intersections	Reduce the crossing distance and vehicle turning speeds by creating tighter turns	◆	◆	◆	◆	◆
Cyclists Want Designated Space						
The following can help create designated space for cyclists (note that designated space is typically more important for casual cyclists than for experienced cyclists):						
Bike Lanes	Particularly needed by casual cyclists on higher-volume, higher-speed streets; 4' minimum, 5' preferred	◆	◆	◆	◆	◆
Bike Boxes at Intersections	Should only be used in conjunction with a bike lane; even if absent from rest of segment, add bike lane on the intersection approach	◆	◆	◆	◆	◇

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Wide Outside Lanes (wosl)	Use as last resort, because generally inappropriate; extra wide lanes might increase traffic speeds; may be allowable if no space for full bike lane; better with edge line	◆	◆	◆	◆	◆
Edge Line	Can better define bike space, if wosl must be used; may also help better confine traffic, though calming benefits unproven	◆	◆	◆	◇	◇
Pavement Markings	Can be particularly useful with wosl's; consider, e.g., the "Denver Arrow" or "Sharrow"	◇	◆	◆	◆	◇
Traffic Calming	Both casual and experienced cyclists may feel more comfortable operating in mixed traffic on lower volume, lower speed streets; for specific calming tools, see CDOT's Traffic Calming Report	◆	◆	◆	◆	◆
Cyclists Want Safer Riding Environment						
To encourage cycling, consider the following to enhance safety:						
Smooth Surfaces	Provide smooth seams between asphalt and gutter; drainage grates should be bike friendly (no parallel-running grates)	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2:1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Street Lighting	Bike lights more useful for visibility to drivers than for lighting the way	◆	◆	◆	◆	◆
No On-Street Parking	Opening car doors create potential hazard; however, wide bikes lanes alleviate this hazard	◆	◆	◆	◆	◆
Separation from On-Street Parking	If on-street parking is used, either parking lane or bike lane should be wider than minimum	◆	◆	◆	◆	◆
No Front-In Angle Parking	Seriously limits cyclists' visibility to drivers; however, reverse angle parking alleviates this hazard	◇	◆	◆	◇	◆
Reverse Angle Parking	Puts cyclist in drivers' sightline, but also requires more space and buffering than parallel parking	◇	◆	◆	◇	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Cyclists Want Safer Crossings						
Consider the following elements to increase cyclists' visibility:						
Bike Boxes	Brings cyclists into drivers' sight; allows cyclists a headstart through an intersection; should provide bike lane approaching intersection	◆	◆	◆	◆	◇
Drop Bike Lane at Intersection	Achieves same as bike box, but without designated space; casual cyclists may feel less comfortable, although it is considered safer to drop the lane and have cyclists merge earlier for left-turns if there is no bike box	◆	◆	◆	◆	◇
Leading Bike Signal	Allows cyclists a headstart through the intersection; requires driver and cyclist education	◆	◆	◆	◆	◇
Short Blocks	Create more intersections, but potentially smaller intersections; more opportunities to avoid high volume routes; can potentially calm traffic and allow more opportunities for safe crossing treatments	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2:1
Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Bike-Sensitive Signals at Intersections	If cyclists can't trip the signal, they're more likely to make unsafe movements	◆	◆	◆	◆	◇
Roundabouts	Slow down motor vehicles at intersections; "equalize" speed of bikes and cars; multiple lane roundabouts more difficult to traverse than single lane roundabouts	◆	◆	◆	◆	◇
Pedestrian Refuges	For casual cyclists, the ability to cross partway and wait may enhance perception of safety; should be 6-8' minimum width to shelter cyclists	◆	◆	◆	◆	◆
Cyclists Want Direct Connections						
The following elements can affect the cyclists' ability to find direct, easy connections:						
Short Blocks	Provide more route options, shorter routes, and more opportunities for safe crossings	◆	◆	◆	◆	◆
Bike/Ped Travelways	When local street connections (preferred) aren't possible	◆	◆	◇	◇	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Cyclists Want Security						
Cyclists are more likely to be or feel vulnerable than are motorists; consider the following elements to enhance cyclists' security:						
Roundabouts	Help reduce the number of stops a cyclist must make	◇	◆	◆	◇	◇
Bike-Sensitive Signals at Intersections	If cyclists can't trip the signal, they're more likely to make unsafe movements	◇	◆	◇	◇	◇
Pedestrian Scale Lighting	Helps identify an area as pedestrian and cyclist friendly; provides additional lighting	◆	◆	◆	◆	◇
Street Lighting	Cyclists can more easily see potential dangers in and along the street	◆	◆	◆	◆	◇
Bike Lockers	Providing storage options at appropriate locations can make the difference between whether a cyclist is able to use this mode; not strictly a street design feature	◇	◆	◇	◆	◇
Bike Racks	Provides similar advantages as, though more exposed than, lockers; either treatment needs to be readily accessible to surrounding land uses; not strictly a street design feature	◇	◆	◇	◆	◇

◆ - Positive Impact ◆ - Negative Impact ◇ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2:1
Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Motorists Want Reduced Delays/Increased Capacity						
The following elements can increase a street's capacity and/or potentially reduce motorists' delay:						
More Travel Lanes	Each additional travel lane increases the street's capacity, especially at intersections; the mix of through and turn lanes can, up to a point, allow an intersection to process more traffic	◆	◆	◆	◆	◆
Design Consistency	By providing a consistent design (number of travel lanes, i.e.), motorists don't have to unexpectedly stop or merge; however, this may be difficult to achieve	◆	◆	◆	◆	◆
Grade Separated Intersections	Allows uninterrupted flow; particularly useful for high volume intersections, but destroys urban context for other users	◆	◆	◆	◆	◆
Unsignalized Intersections	May mean less delay for the higher-volume leg, but more delay for the lower-volume leg; in general, fewer signals means less delay on thoroughfares, but may also mean less connectivity	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Signal Timing & Phasing, Progression	Signals can be phased and timed to reduce vehicular delay overall or by approach; progression may help reduce delay along higher-volume streets	◆	◆	◆	◆	◆
Roundabouts	Allow more traffic to flow through an intersection in a given period of time than with either unsignalized or signalized intersections; for all users, dual lane roundabouts less easy to navigate than single lane roundabouts	◆	◆	◆	◆	◇
Turn Lanes	Left turn lanes, in particular, allow through traffic to continue to move; at signalized intersections, creating separate phases along with turn lanes may increase overall delay	◆	◆	◆	◆	◆
Dual Left Turn Lanes	Can increase intersection's capacity to process traffic; creates wider intersections, but can also allow more efficient signal timing for other traffic movements	◆	◆	◆	◆	◆
Bus Pullouts	Remove stopped buses from travel lanes; bus drivers may find it difficult to re-merge into traffic	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2:1
Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Motorists Want Safety						
The following elements are traditionally assumed to increase motorists' safety:						
Wider Lanes	May provide drivers more room for error; however, in combination with other features, may also increase speeds, because drivers feel more comfortable driving faster	◆	◆	◆	◆	◆
Clear Zone	Removing objects for some distance from the travel lanes improves sight distance and leaves room for error; but this may also increase speeds	◆	◆	◆	◆	◆
Increased Sight Distance	Increasing sight distance can improve overall visibility; appropriate sight distance depends on type of traffic control at intersections, speeds, and context; application should vary by intersection type	◇	◆	◆	◆	◆
Medians	Separate opposing traffic streams and minimize vehicle/vehicle and vehicle/pedestrian conflicts; but may increase traffic speeds	◆	◆	◆	◆	◆
Turn Lanes	Turn lanes, particularly for left turns and on higher-speed streets, reduce the potential for rear-end collisions	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Street Lighting	Increases visibility and potentially reduces conflicts	◆	◆	◆	◆	◆
Motorists Want Speed						
The following elements may allow motorists to travel at higher speeds:						
Wide Travel Lanes	Combined with total cross-section width and straightness of street, may make drivers feel more comfortable driving at higher speeds	◆	◆	◆	◆	◆
Clear Zone	Removing objects for some distance from the travel lanes improves sight distance and may make drivers feel more comfortable driving at higher speeds	◆	◆	◆	◆	◆
Lack of Street Trees	In combination with other elements listed above, may make drivers more comfortable driving at higher speeds because of increased sight distance;	◆	◆	◆	◆	◆
Wide Overall Cross-section	A wide street, with few visible obstructions, tends to make drivers feel comfortable driving at higher speeds	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2:1
Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Medians	Separating opposing traffic streams may make drivers feel more comfortable driving at hgher speeds	◇	◇	◆	◆	◇
Consistent Vertical and Horizontal Alignment	Straighter and flatter streets typically encourage motorists to drive faster	◇	◇	◆	◆	◇
Large Curb Radii at Intersections	Allow motorists to make sweeping turns, meaning they can turn at a higher rate of speed	◆	◇	◆	◆	◇
Motorists Want to Minimize Conflicts						
Minimizing conflicts is related to both safety and speed; the following elements can help minimize conflicts:						
Medians	Provide a buffer between opposing traffic streams; can help create higher speeds; requires more right-of-way and can limit access to adjacent land	◇	◇	◆	◆	◇
Grade Separated Intersections	Allow traffic to continue with little delay and exposure to conflicting traffic movements, but destroys urban context for other users	◆	◇	◆	◇	◆
Bike Lanes	Take cyclists out of travel lanes, easing motorists' confusion	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◇ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Sidewalks	Provide a separate space for pedestrians; keep them away from travel lanes, particularly when combined with other buffers	◆	◆	◆	◆	◆
Access Controls	Reduce the incidence of vehicles slowing and turning into/out of driveways; however, can limit direct access to land uses	◆	◆	◆	◆	◇
Signalization	Signal controlled intersections help limit direct vehicle/vehicle and vehicle/pedestrian conflicts	◆	◇	◇	◇	○
The requirements of transit drivers differ from those of transit riders; riders have basically the same perspective as other pedestrians; drivers have basically the same perspective as drivers of other large vehicles						
Transit Drivers Want Space to Maneuver						
The following elements can provide the space for buses (and other large vehicles):						
Wide Travel Lanes	12' feet preferred by transit operators	◇	◇	◆	◆	◇
Large Curb Radii at Intersections	Allow buses to turn more easily, by creating space for "sweeping" turns	◆	◇	◆	◆	◇

◆ - Positive Impact ◆ - Negative Impact ◇- Mixed Impact or Use With Caution ○- Neutral

Figure 2:1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Clear Zone	A clear zone between the travel lane and parked cars, utility poles, and trees reduces the likelihood of side mirrors hitting objects	◆	◆	◆	◆	◆
Mountable Curbs on Medians or Corners	Allow bus drivers to maneuver around corners, if curb radius is too tight	◆	◆	◇	◆	◆
Transit Drivers or Passengers Want Access to Loading/Unloading Passengers						
Some of the following elements refer to the drivers' perspective, others to the passengers' perspective:						
Waiting Pads	Provide a hard surface and designated waiting and loading area for passengers, if there is no sidewalk and/or amenity zone	◇	◇	◇	◆	◇
Curb Extensions	Allow passengers direct access off of curb and onto bus; bus doesn't have to leave travel lane	◆	◆	◆	◆	◆
Amenity Zone	Bus passengers don't have to wait or walk on grass	◆	◇	◆	◆	◆
Bus Shelters	Create a designated, comfortable waiting space for passengers	◆	◇	◇	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

Figure 2.1

Design Element Matrix – Different User Perspectives (cont'd)

		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Street Furniture	Benches, trash cans, etc. can make waiting for the bus more comfortable	◆	◆	◇	◆	◆
Transit Riders Want Safety/Security						
The elements that provide security for transit riders and drivers are the same as those for pedestrians and motorists, respectively, with a few exceptions; waiting riders may feel more vulnerable than other pedestrians because they are stationary; the following can help:						
Appropriately Located Stops	Transit stops should generally be located in well-traveled, visible areas	◇	◇	◇	◆	◆
Pedestrian Lighting at Bus Stops	Clearly identifies the space and provides added visibility to and of the passengers; particularly important in less traveled areas	◆	◆	◆	◆	◆

◆ - Positive Impact ◆ - Negative Impact ◆ - Mixed Impact or Use With Caution ◇ - Neutral

* **Transit** — the matrix treats "transit" from the Transit Drivers' perspective, since riders share the characteristics and expectations discussed for other pedestrians.