

02 Complete Streets Basics

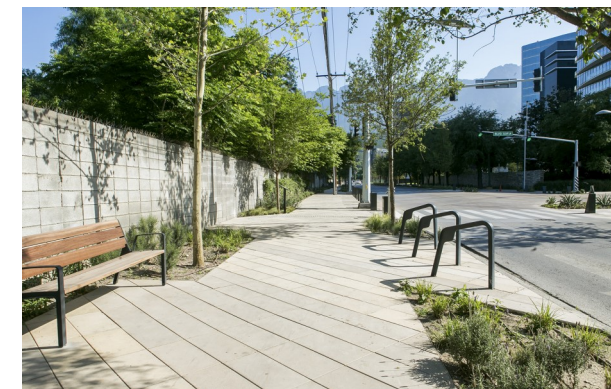
2.1. Components of a Streetscape

Understanding and providing the physical space for the various components that make-up a streetscape is essential in creating a flourishing street. These components are often divided into two categories; 1) the pedestrian realm, and 2) the multi-modal vehicular realm.

2.1.1. Pedestrian Realm

The pedestrian realm is the space between the vehicular roadway and adjacent building frontage. Depending on the land use, this space should be designed to accommodate a range of activity including, walking, sitting, socializing, dining and commerce. The physical components of the pedestrian realm include:

- Sidewalks;
- Multi-use paths;
- Building frontage;
- Street trees;
- Bulb-outs;
- Furnishings;
- Signage, wayfinding and public art;
- Pedestrian Lighting; and
- Landscaping.



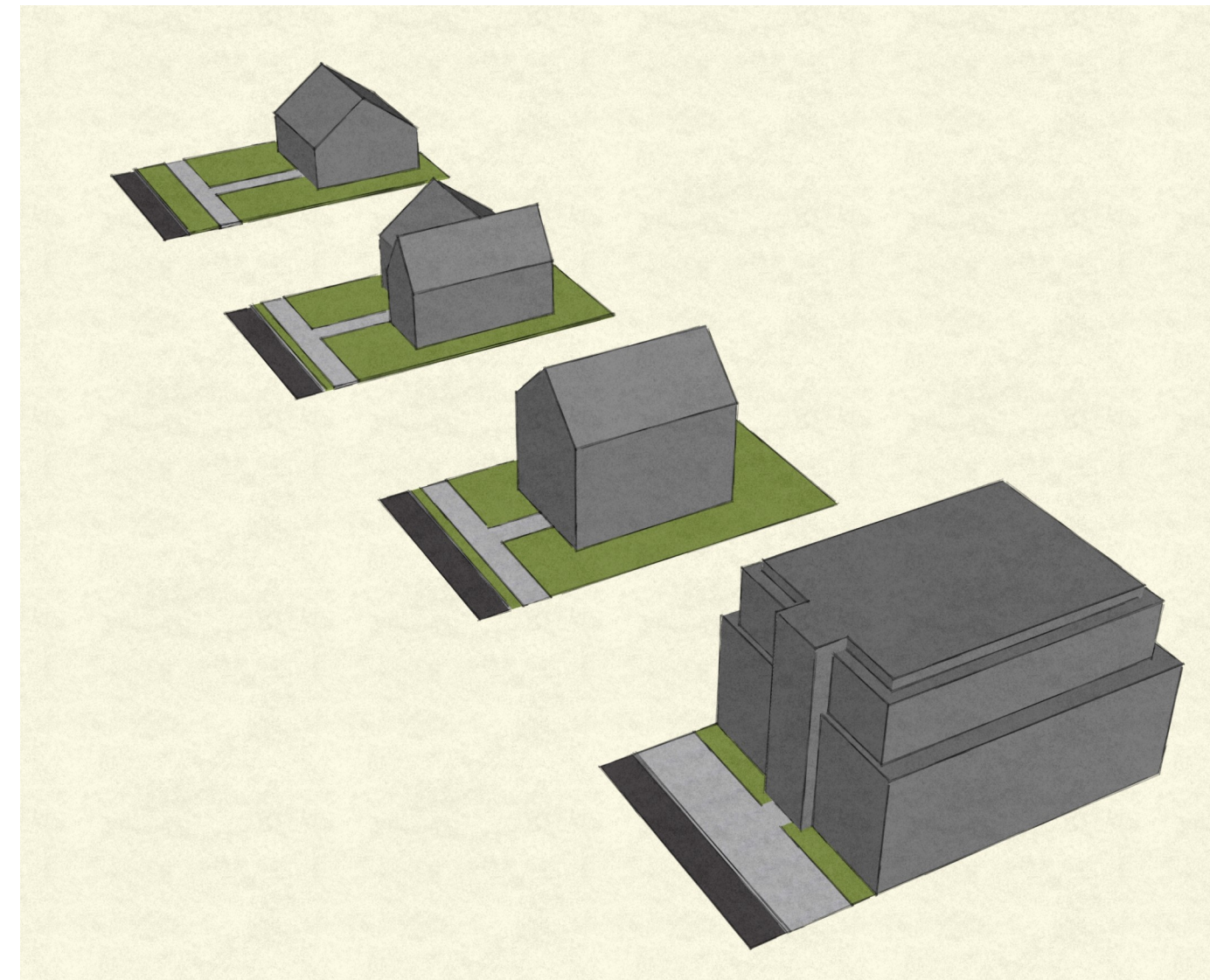
The Pedestrian Realm can further be divided into Development, Green and Sidewalk/Multi-Use Path Zones, components of which are discussed below.

Development Zone

According to the 2012 NCDOT Complete Streets Planning and Design Guidelines*, "the Development Zone is the area outside the street right of way (ROW) where public or private property is located or may be planned in the future. The relationship of the buildings in the development zone to the street is an important component of the character of the street, as well as how it functions for the street users. In a downtown area, it is likely that this zone includes buildings fronting or very near the back of the sidewalk. In suburban or rural areas, the development zone is more likely to include a deeper setback between the street and the developed portion of the street front (the buildings). Depending on context, this area could be a parking lot, a front lawn to a residence, or undeveloped land. In some cases, ROW for a utility strip is required behind a sidewalk which effectively shifts the development zone farther from the street."

"Since the Development Zone is outside the street ROW, the types of street elements in this area can vary widely. Elements specific to the transportation network may include:

- Bicycle or pedestrian paths;
- Transit stops or facilities;
- Public parking lots; or
- Driveway connections between private parcels."



Example of Building Sites with Different Development Zones

*** This study references several different NCDOT Roadway Design documents for the following reasons —**

The 2019 Complete Streets Policy (<https://www.completestreetsnc.org>) states that it supersedes the 2012 Complete Streets Planning and Design Guidelines (http://www.completestreetsnc.org/wp-content/themes/CompleteStreets_Custom/pdfs/NCDOT-Complete-Streets-Planning-Design-Guidelines.pdf), which are being currently revised. As such, it refers to the Current Roadway Design Manual (<https://connect.ncdot.gov/projects/Roadway/Pages/Roadway-Design-Manual.aspx>) for design guidance. However, except for a few basic elements, the Current Roadway Design Manual provides limited guidance for complete street elements. In those instances, this study refers to the 2012 Complete Streets Design Manual for guidance.

Green Zone

It is widely accepted roadway design practice that there should be a green zone or buffer between moving traffic and pedestrians, as noted below (see bottom of page for references):

According to the 2012 NCDOT Complete Streets Manual, "the green zone is generally a landscaped area between the street pavement (or curb) and the sidewalk. In general, the street designs provide a minimum of 6 to 8 feet in this area to allow space for street trees. Street trees buffer pedestrians and other street users from vehicular traffic, as well as providing for shade and an attractive public realm. Within a high-density urban area, the green zone may be hardscaped with trees in planters. In addition to street trees, green zone elements may include features such as other landscaping, signs, benches, fire hydrants, street and pedestrian light poles, and utility poles. Transit amenities such as bus shelters can be considered, but would typically be accommodated behind the green zone."

FHWA states that, "the preferred minimum width for a nature strip is 5 to 7 feet. A nature strip this wide provides ample storage room for many utilities. The width provides an essential buffer between an out-of-control motorist and a pedestrian, improved sight distances at driveways, and adequate width for landscaping and street trees." (1)

According to PEDSAFE (Pedestrian Safety Guide and Countermeasure Selection System) which evaluates FHWA and AASHTO (American Association of State Highway and Transportation Officials) guidance among others, "the ideal width of a planting strip is 6 ft. Minimum allowable landscape buffer widths are 2-4 feet for local or collector streets and 4-6 feet for arterial/major streets." (2)

According to the Sustainable City Code, "The size of a buffer zone can and should vary according to the sidewalk location. For instance, in downtown or commercial districts street furniture, low vegetation, trees, or a bike lane may be an appropriate buffer, while in more suburban areas, a landscape strip or increased vegetation may be preferable. When drafting an ordinance to address sidewalk width and buffer zones, local governments should consider the following factors: street type, adjacent land use, adjacent building height, and roadway characteristics. Areas with higher pedestrian traffic, such as large shopping centers, schools, or tourist attractions, may require wider minimum requirements, such as fifteen feet, which may help encourage pedestrian mobility. In more rural or suburban areas, narrower sidewalk requirements may suffice, such as six feet." (3)

NOTED References:

(1) FHWA COURSE ON BICYCLE AND PEDESTRIAN TRANSPORTATION WALKWAYS, SIDEWALKS, AND PUBLIC SPACES LESSON 13

(2) http://www.pedbikesafe.org/pedsafe/resources_guidelines_sidwalkswalkways.cfm

(3) <https://sustainablecitycode.org/brief/minimum-width-and-buffer-requirements-for-sidewalks-3/>



Examples of Green Zones



Sidewalk / Multi-Use Path Zone

Sidewalks play an important role in the life of a town. “As conduits for pedestrian movement and access, they enhance connectivity and promote walking” (NACTO Urban Street Design Guide). The term **Active Transportation** refers forms of travel that require the user to exercise, usually bicycle and pedestrian movement. In the United States where one of four adults do not engage in regular exercise, implementing safe bicycle and pedestrian facilities can improve the public health of the community. As public spaces, sidewalks serve as the “front steps” to the town, cultivating social and economic interactions.

According to the 2012 NCDOT Complete Streets Manual, “this area is reserved primarily for a paved sidewalk to carry pedestrians and provide access to transit and to adjacent land uses. In urban and suburban areas, the expectation is to provide sidewalks on both sides of the street unless there are site-specific constraints that make this impossible. When planning for, or accommodating, transit, safe and accessible pedestrian connections are needed between adjacent land uses and transit stops.”

“Detached sidewalks (located behind the green zone) are preferred because they separate (or buffer) pedestrians from moving traffic and allow for a planting area between the sidewalk and travel lanes. Sidewalk widths vary based on the street type and context. Recommended sidewalk widths range from 6 to 12 feet. Narrower sidewalks (5 feet) may be sufficient for local/subdivision streets in areas with low to medium land use densities. Wider sidewalks (up to 12 feet) are preferred in urban or main street settings with higher levels of pedestrian activity.”

“In urban areas or other areas with intensive development, it may be necessary to provide wider sidewalks extending to the face of existing buildings. Generally, the sidewalk zone should allow for unobstructed sidewalk width. Street and transit furniture (such as benches, trash cans, and newspaper racks), should be placed within the green zone or development zone, rather than the sidewalk zone, if there is sufficient width and offset from the curb.”

“On parkways or rural roads, instead of a sidewalk, the pedestrian space may consist of a multi-use path zone set back from the roadway. Multi-use paths are separate facilities that serve pedestrians and bicyclists. The multi-use path should be wide

4) Kirschbaum, Julie B, PW Axelson, PE Longmuir, KM Mispagel, JA Stein, & DA Yamada. “Designing Sidewalks and Trails for Access, Part II of II: Best Practices Design Guide.” Bicycle & Pedestrian Section, Federal Highway Administration, Washington, DC: 2001.

enough to serve bicyclists and pedestrians safely. The preferred cross-section is 10 to 12 feet with two-foot gravel shoulders on each side. A green zone and natural zone help provide a buffer from the main travel way.”

Narrow Sidewalks

According to the FHWA document *Designing Sidewalks and Trails for Access: Best Practices Guide* (4) which specifies the requirements of ADA-complaint roadway design, narrow sidewalk corridors (like in portions of the project corridor) are “unsatisfactory because they limit the number of pedestrians that can use the area, require pedestrians to travel single file, and force pedestrians to travel uncomfortably close to buildings and/or automobile traffic. Access is easily compromised on narrow sidewalk corridors by objects, such as utility poles, that create even narrower spaces. Sometimes, narrow sidewalks do not provide enough clear space for people who use walking aids or wheelchairs to travel down the length of the sidewalk. In addition, narrow sidewalk corridors often have driveway crossings with steep cross slopes and curb ramps with insufficient landings and/or steep ramp grades.”



2.1.2. Motor Vehicle / Shared Vehicle (or Multimodal Vehicle) Realm

The physical components of the motor / shared / multi-modal vehicle realm includes:

- Travel lanes and medians;
- Turn lanes and tapers;
- Channelized or striped pavement areas;
- Gutter pans;
- On-street / striped bicycle lanes;
- Crosswalks
- Shared travel lanes / Sharrows (where vehicles and bicycles share the lane)
- Transit pull offs and stops;
- On-street parking;
- Street lighting; and
- Intersections.

According to the 2012 NCDOT Complete Streets Manual, “the multi-modal vehicular realm is generally considered the paved travel way of a street. Travel lanes are important for vehicular movement and capacity along a corridor. Travel lane considerations include the number and width of lanes, the street direction (one-way or two-way), and the width and incorporation of turn lanes. It is also important to consider these elements from the standpoint of their impact on other users. Street width, for example, can affect the ability of pedestrians to cross the street or the potential provision of bike lanes.”

“The majority of street cross-sections in these guidelines show a range of lane widths from 10 to 12 feet. The recommendation for 10- to 11-foot lanes reflects that, for most urban and suburban street types, lanes less than 12 feet wide are both safe and appropriate, can help to reduce the overall footprint of the street, and/or allow space for other users of the street. Additional considerations include the need for turn lanes at intersections. Sufficient width and need for turn lanes should be evaluated within the context of the larger corridor.”

“A shared vehicle zone allows for both motorized and non-motorized vehicles, and typically includes additional pavement for bicycles. The preferred treatment for bicycles on higher volume and speed streets is a separate bicycle lane. If a shared vehicle zone is used instead, it might consist of additional space for a shared lane, additional space with shared lane markings, or on very low-volume, low-speed streets, a regular travel lane. The gutter pan is not considered part of the bicycle facility.”

“Parking may or may not be provided along a street. The relationship between parking lane width and vehicular lane width should be evaluated (in corridors with parking, vehicular lanes may need to be wider, depending on the street type and context). If a parking zone is adjacent to the traveled way, additional offset may be provided. Transit vehicles will often utilize the motor vehicle zone for bus stops if bus pull-offs are not provided or appropriate.”

Medians may or may not be provided along a street. “The median zone typically provides a landscaped buffer between traffic moving in opposing directions. Medians can also help to provide for pedestrian refuge opportunities in



some contexts. Parkways and boulevards typically have a median, avenues may have a median, and main streets may have a median, though it is atypical. Rather than continuous medians, avenues may typically include intermittent landscaped islands to allow for more access, breaks in center turn lanes, and provide pedestrian refuge opportunities. Most two-lane streets do not have a median."

"The primary considerations with medians include width and treatment. Median widths vary from 8 feet to 46 feet depending on street type and context. In most urban and suburban locations, curbs will be used to delineate the median from the traveled way. Median breaks should be identified early in the design and should be located to allow for access and to maintain network connectivity. The median zone typically includes street trees and shrubbery. Hardscaping may be provided at narrow points and at specified crossing points to facilitate pedestrian use. At crossing points, landscaping and limbs should be maintained to allow visibility for the pedestrian and motorist."

Haggard Avenue is classified by NCDOT as a minor arterial. A future traffic capacity analysis should be conducted to confirm necessary breaks in the median to provide access to driveways and side streets. To enhance mobility and maintain the suburban highway character of the western and eastern gateways to Haggard Avenue, medians are recommended only near Downtown and Elon University Campus core area. See section 3.4.4. for more details.



Planted Median and Buffered Bike Lane, Virginia DOT.

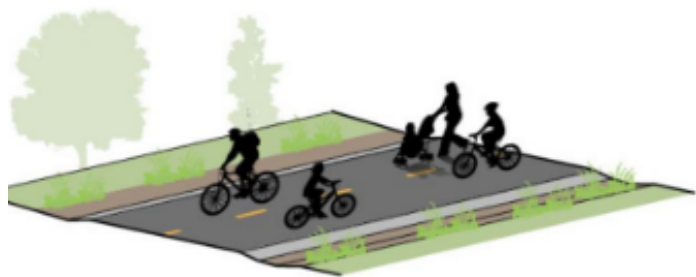
2.2. Multimodal Safety Enhancements

Safety is typically a primary concern when users consider alternative modes of travel, but it can often be hard to qualify. As designers, selecting the best type of facility for each unique situation can provide a sense of comfort and convenience to the community. Vision Zero is a strategy to eliminate traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all. The approach recognizes that people will sometimes make mistakes, so we have a responsibility to design and operate a transportation system that makes inevitable mistakes less severe. The Haggard Avenue corridor study recommends implementing physical barriers between vehicles and bicycle/pedestrian facilities so that if and when accidents happen, fatalities and severe injuries can be prevented.

Safety features in this section are discussed in two separate categories, treatments along the corridor that can mitigate side-swipe type crashes and treatments at intersections that can mitigate head-on or T-shaped crashes.

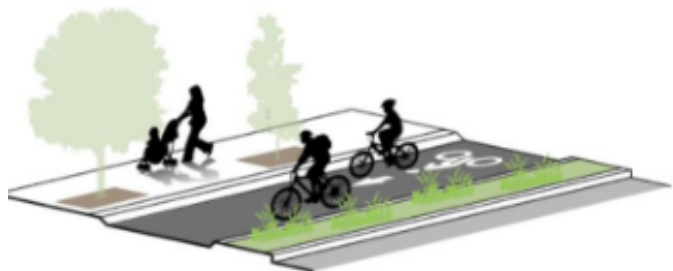


Multiuse paths are family friendly and an example of designing for all ages and abilities. www.pedbikeimages.org / Toole Design Group



MULTIUSE PATH / BI-DIRECTIONAL PATH

Non-motorized pathway in an independent right of way or parallel to a roadway. A multiuse path is proposed as a primary feature along Haggard Avenue to serve both pedestrians and bicyclists.



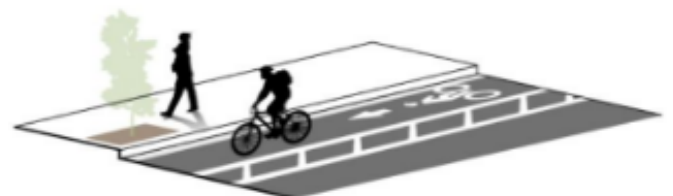
ONE-WAY SEPARATED BIKE LANE

Physically separated bike lanes. Also known as a protected bike lane. This feature was not recommended due to right of way restrictions.



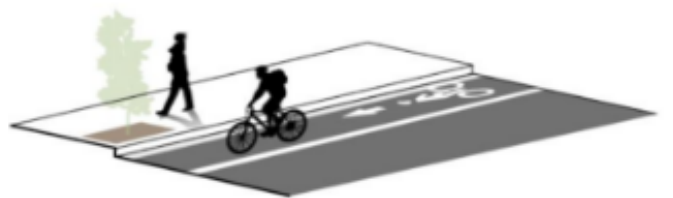
CYCLE TRACK / TWO-WAY SEPARATE BIKE LANE

Physically separated bike lanes designed for bi-directional use. This option was discussed with stakeholders in the historic campus section but there were concerns of user confusion.



BUFFERED BIKE LANE

On-street bike lanes paired with a designated buffer space. Recommended in the historic campus section.



ON-STREET BIKE LANE

Designate an exclusive space for bicyclists through the use of pavement markings and signage. Perceived as unsafe by some stakeholders and public. Not appropriate under certain traffic speed conditions. Possibility of bicycle-vehicle conflict.



SHARED ROADWAY

Shared roadways (which may be designated bike routes) are roadways without dedicated bicycle facilities. Shared Lane Markings (SLM) may be included. This option was perceived as unsafe by the public and stakeholders and not recommended.

Corridor Best Practices

Many different facility types have been used worldwide to improve safety and visibility for bicyclists. The most widely known bicycle facility is perhaps one of the least expensive, the **on-street bicycle lane** (6). An on-street bicycle lane is designated by a painted stripe on the road, usually four or five feet wide.

A **buffered bicycle lane** is similar to an on-street bicycle lane but includes a buffer space, usually about a foot or two of diagonally striped space to offset the bicycle traffic from the vehicle traffic (7).

Bicycle routes on a **shared roadway** share the vehicle lane with vehicles but are designated by signage or **sharrows** instead of a painted stripe.

A **multiuse path** is one example of a separated bike lane and is usually bi-directional.

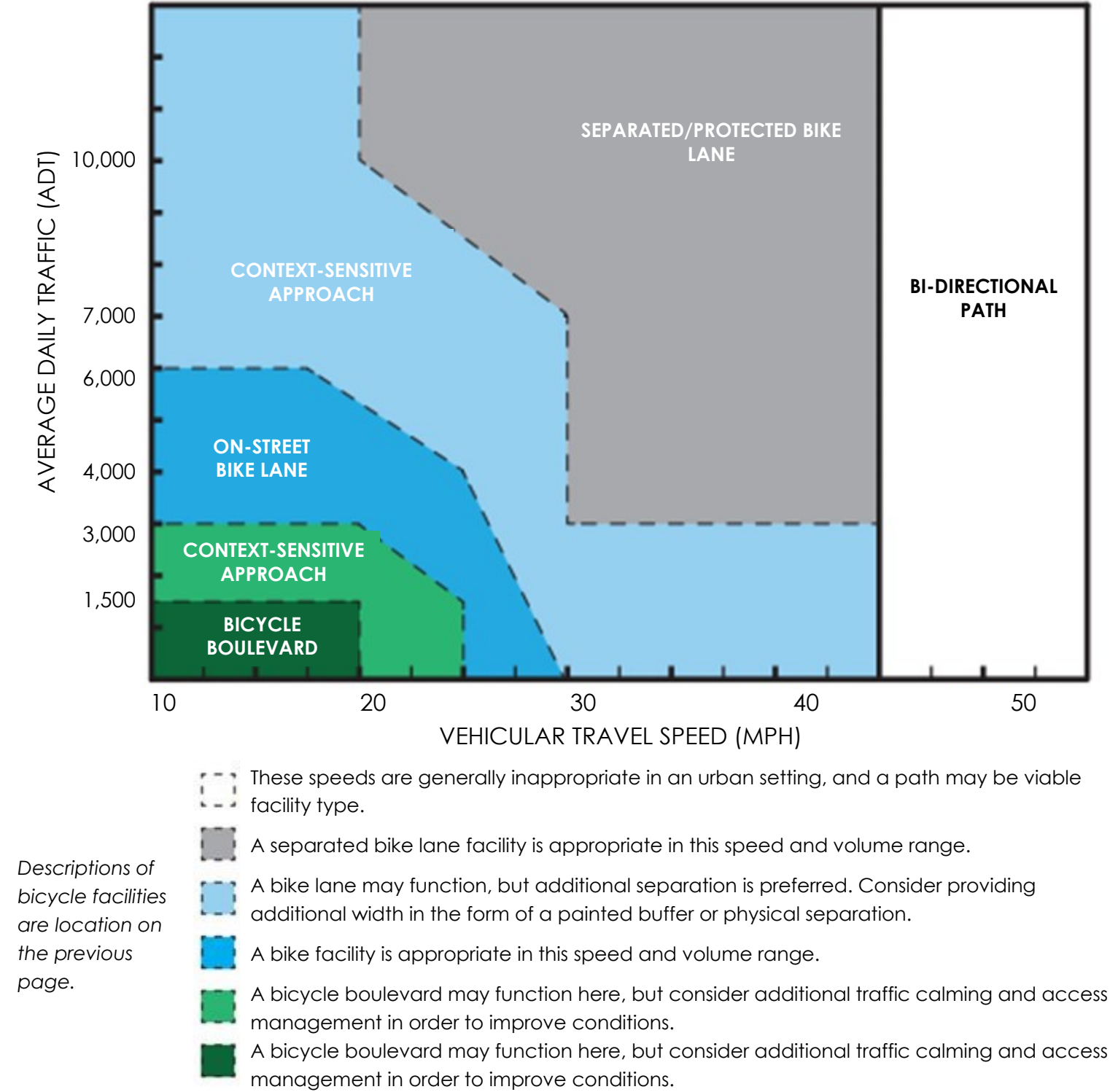
Green pavement markings increase the visibility of bicycle facilities. They can be used along the entire length of the bike lane or as spot treatment to highlight potential conflict areas.

6) Gilpin, J., Falbo, N., Repsch, M., Zimmerman, A., 2015. Lessons Learned: Evolution of the Protected Intersection. Published by Alta Planning + Design. https://altaplanning.com/wp-content/uploads/Evolution-of-the-Protected-Intersection_ALTA-2015.pdf, Accessed April 8, 2019.

7) City of Charlotte Department of Transportation (CDOT). Charlotte Bikes: Bicycle Plan. Adopted by Charlotte City Council, North Carolina, 2017. <http://charlottenc.gov/Transportation/Programs/Documents/Charlotte%20BIKES%20Final.pdf>, Accessed April 8, 2019.

8) National Association of City Transportation Officials (NACTO). Urban Bikeway Design Guide (Second edition.). Washington, DC: Island Press/Center for Resource Economics, 2014.

The posted speed limit on the NCDOT controlled portions of the Haggard Avenue corridor is 35 mph, with AADT warranting a separated bike lane according to the above NACTO design guide. In the Campus section where the posted speed limit is lower, a bike lane facility is appropriate, and a protected bike lane is the best practice to accommodate riders of all ages and abilities.



NACTO, Urban Bikeway Design Guide.

Intersection and Crossing Treatments

On-street bicycle lanes, buffered bicycle lanes, and bicycle routes provide varying degrees of protection and safety enhancements along a corridor. However, as soon as the bicyclist enters an intersection, he or she is exposed to the most severe types of crashes and yet left virtually unprotected. An example intersection-specific design improvement for bicyclists is “**bicycle boxes**.” They are a designated region at an intersection allowing bicyclists to get ahead of queuing vehicular traffic. The bicycle boxes are often brightly painted to increase bicyclist visibility (8).

Existing raised crosswalks in the Campus Scale character area are a great example of a traffic calming feature that also enhances driver experience. By combining ramped speed tables with marked pedestrian crossings, pedestrians are made more visible to drivers and drivers are forced to slow down.



Green pavement markings, bike boxes, and two-stage left turns, Virginia DOT.

Rectangular Rapid Flashing Beacons (RRFB) are recommended at 4 midblock crossings along the corridor, particularly in the Suburban Highway character area of the corridor where the speed limit is 35 mph. Studies have shown that the RRFBs can improve driver yield rates up to 96% and reduce crashes by 47%. In areas with low visibility, particularly along curves, a flashing beacon can raise awareness of pedestrians. Unlike raised crosswalks, RRFBs will only slow drivers when a pedestrian initiates the signal, providing greater mobility along the NCDOT regulated segments of the corridor.



Solar Powered RRFB.
Www.pedbikeimages.org / Michael Frederick



Green Pavement Markings and Crosswalk
Www.pedbikeimages.org / Shawn Turner

2.3. What Makes a Great Street?

The character of a street is defined by both land use and street design. And streets can achieve a variety of community goals when thought of as more than a way to get from point “a” to point “b.” Urban designer Allan Jacobs describes “great streets” as those that “make community” and a “great street should be a most desirable place to be, to spend time, to live, to play, to work, at the same time that it markedly contributes to what a city should be.”¹

Great streets are therefore not simply about the street itself, but the space from building face to building face, including surrounding parks and open spaces, that enclose a public realm and houses a diverse range of uses and needs.

Great streets do not happen by accident. They require a thoughtful and negotiated balance of sometimes competing uses and functional desires.

According to the American Planning Association (APA)², elements that make a great street include “maintenance, sustainability, and safety.

A key element of a great street is connectivity: whether it is linked to a larger street network.

Great streets are those that take advantage of natural features and bow to fine architecture. They encourage social activities and take all types of users into account, not just drivers. Most important, great streets have some memorable feature — tall trees, pleasant houses, a row of small shops, a popular cafe.”

1 - Jacobs, Allan B., 1993. "Great Streets," University of California Transportation Center, Working Papers , University of California Transportation Center

2 - <https://www.planning.org/planning/2008/jan/greatstreets.htm>

The APA* further lists the following characteristics of great streets:

- Provides orientation to its users, and connects well to the larger pattern of ways.
- Balances the competing needs of the street — driving, transit, walking, cycling, servicing, parking, drop-offs, etc.
- Fits the topography and capitalizes on natural features.
- Is lined with a variety of interesting activities and uses that create a varied streetscape.
- Has urban design or architectural features that are exemplary in design.
- Relates well to its bordering uses — allows for continuous activity, doesn't displace pedestrians to provide access to bordering uses.
- Encourages human contact and social activities.
- Employs hardscape and/or landscape to great effect.
- Promotes safety of pedestrians and vehicles and promotes use over the 24-hour day.
- Promotes sustainability through minimizing runoff, reusing water, ensuring groundwater quality, minimizing heat islands, and responding to climatic demands.
- Is well maintained, and capable of being maintained without excessive costs.
- Has a memorable character.