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Merrimon Avenue Assessment & Advocacy Opportunities

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February 2022

The reconfiguration of Merrimon Avenue from a four-lane street to a three-lane street with bike lanes is supported by more than 15 years of City, MPO, and NCDOT plans and policies. It is also supported by published design guidance and policies from the Federal Highway Administration and AASHTO.

City of Asheville

- ✓ Complete Streets Policy (2012)
- ✓ Comprehensive Bicycle Plan (2008)
- ✓ Asheville in Motion (2016)
- ✓ Comprehensive Plan (2018)

French Broad River MPO

- ✓ Complete Streets Policy (2013)
- ✓ Comprehensive Transportation Plan (2008)
- ✓ Metropolitan Transportation Plan (2020)
- ✓ Congestion Management Process (2018)

Federal Highway Administration

- ✓ Safe Systems / Vision Zero
- ✓ Bikeway Selection Guide
- ✓ Bike/Ped Design Flexibility Policy
- ✓ Road Diet Informational Guide

NCDOT

- ✓ Mission (Current)
- ✓ Complete Streets Policy (2009, 2019)
- ✓ Complete Streets Planning & Design Guidelines (2012)
- ✓ Roadway Design Manual (2021)
- ✓ Context Sensitive Solutions (2003)
- ✓ Vision Zero Policy (2015)
- ✓ WalkBikeNC Plan (2013)
- ✓ Transportation-Health Policy (2012)
- ✓ Executive Order 246
- ✓ AECOM Traffic Study (2021)

AASHTO

- ✓ Green Book
- ✓ A Guide to Achieving Flexibility in Highway Design

Key Talking Points

Use "Road Reconfiguration" instead of "Road Diet." This helps to better frame the purpose of the project. Using "Road Diet" leads to a greater sense that motorists are having something taken from them versus having a road reconfigured to improve the operations and safety of the street.

Highlight that the Merrimon Avenue reconfiguration is supported by more than 15 years of transportation planning and policies, not only by the City of Asheville, but also by the French Broad River MPO, the MPO's Board of elected officials, and NCDOT Division 13.

Despite growth in areas to the north of the Merrimon Avenue Corridor—Woodfin, Weaverville, north Asheville—the route has experienced no increase in traffic volumes since 2000.

There is ample support in national design guidance from the Federal Highway Administration and AASHTO for the reconfiguration of Merrimon Avenue, as well as within NCDOT's Roadway Design Manual. Speed management techniques should be applied to the design given it is infeasible for Merrimon to have separated bike lanes.

There is no policy or standard dictating a level of motor vehicle traffic volumes at which a road reconfiguration cannot be one. Nor is there a policy or standard that dictates what level of motor level of service must be protected. There is only guidance, with FHWA noting that local agencies are free to make their own design decisions based on community goals and context.

Any road reconfiguration should come with improved traffic signal functions to interconnect signals, provide signal pre-emption for emergency services, time of day signal operations, installation of loop detection for bicyclists in the bike lanes, and "rest in walk" phasing for pedestrians crossing side streets. Retiming signals pre-construction should be done to get motorist accustomed to the new timing.

The City of Asheville should adopt policies to ensure that land use development along Merrimon Avenue results in dedication of additional right-of-way and roadway improvements to create: Buffered sidewalks, concrete gutter exclusive of bike lane width, bus pullouts, and consolidation of driveways.

The City must ensure development along the corridor has site designs, densities, and uses that promote the multimodal vision for Merrimon so there is not future pressure to add motor vehicle lanes. (e.g. Patton Avenue "urban village" at the old Kmart that is now going to be a typical Ingles)

Merrimon Avenue Context

Merrimon Avenue is a north-south arterial street that cuts through the heart of north Asheville neighborhoods. Today, it is configured primarily as a four-lane road with sidewalks and no bike lanes. It is a public street with the roadway segments between the curbs managed by the North Carolina Department of Transportation; the City of Asheville is legally required by NCDOT policy to manage the sidewalks. Merrimon is designated as US Highway 25, which is a relic of the function the route served prior to construction of nearby Future I-26.

The appearance of the corridor indicates that past efforts to maximize motor vehicle throughput have pushed the sidewalks to the minimum widths, with no buffer from the street. Historical images from nearly 100 years ago (right) show streetcar tracks running down Merrimon, a testament to its historic role in better serving modes other than motor vehicle traffic.

Merrimon Avenue near Chestnut, circa 1925.
Source: E.M. Ball Collection, UNC Asheville

The result is a corridor that doesn't work well for any road user, including motorists. The Federal Highway Administration highlights the safety issues prevalent with four-lane streets like Merrimon and supports reconfiguration to a three-lane street due to these safety and operational factors:

- Four-lane undivided highways experience relatively high crash frequencies — especially as traffic volumes and turning movements increase over time — resulting in conflicts between high-speed through traffic, left-turning vehicles and other road users. FHWA has deemed Road Diets a proven safety countermeasure and promotes them as a safety-focused design alternative to a traditional four-lane, undivided roadway (1).

Four-lane streets that lack a center turn lane, like Merrimon Avenue, are referred to by FHWA as "de facto three-lane roadway... where left-turning vehicles along the existing four-lane undivided roadway have resulted in the majority of the through traffic using the outside lanes." (2)

Figure 1: Proposed Roadway Reconfiguration of Merrimon Avenue

By reconfiguring Merrimon Avenue to provide a two-way left turn lane, it has the potential to provide for better traffic flow and decrease motor vehicle crashes. The added safety benefits of a roadway reconfiguration mean the fourth lane can be reallocated to use as a lane for people who bike, which provides greater separation for pedestrians from motor vehicle traffic.

City of Asheville Supporting Actions

Complete Streets Policy. In 2012 the City of Asheville adopted its Complete Streets policy. That policy states the city "desires that all users of our transportation system are able to travel safely and conveniently along and across all streets and roadways within the public right-of-way in Asheville." Further statements in the policy support the need for bicyclists of all ages and abilities to be accommodated. It also notes that with increased congestion comes a need to provide options for people to use modes of transportation other than the automobile. The policy references the City's Comprehensive Bicycle Plan.

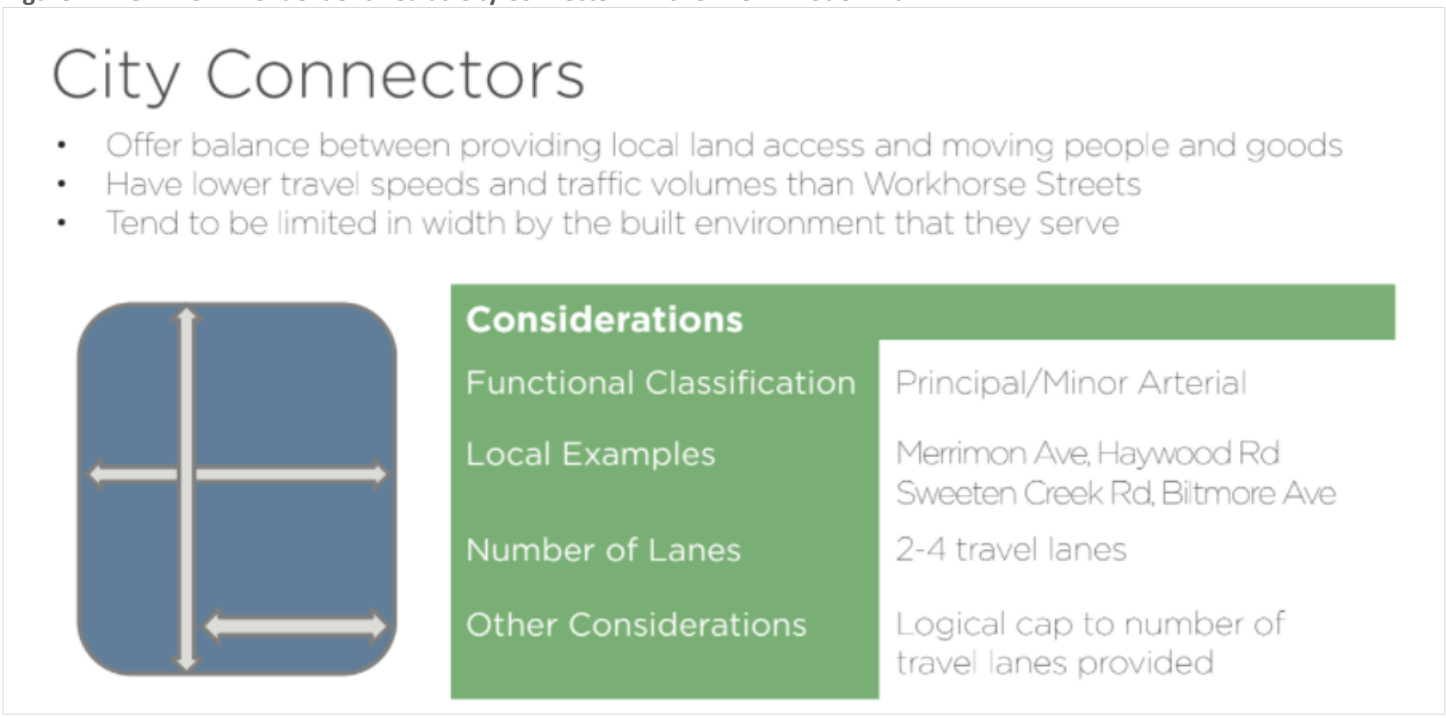
Comprehensive Bicycle Plan. The City's support for bike lanes on Merrimon Avenue dates back 15 years to the start of the Comprehensive Bicycle Plan, which was adopted in February 2008 (4). The steering committee for the plan consisted of representatives from the City, French Broad River MPO, NCDOT Division 13, and the NC Board of Transportation Bicycle Representative for Divisions 13 and 14. This plan, which was funded and endorsed by NCDOT, states this:

- "The primary goal of this Plan is to provide transportation alternatives and to enhance quality of life by creating continuous linear bicycle connections, providing bicycle facilities for the full range of users, and increasing safety and mobility of bicyclists in Asheville." (page 4)

The proposed reconfiguration of Merrimon Avenue supports this vision. The Plan designates Merrimon Avenue for a "lane diet" for much of its length. This stemmed from online input from 800 survey respondents where Merrimon was highlighted as a route in need of improvements for people who bike. In that plan, a lane diet was noted as a restriping of roadways to narrow motor vehicle travel lanes in order to add bike lanes. Merrimon is noted in the plan as being in most need of a climbing lane for bicyclists in uphill stretches and posed as having some type of shared lane applications elsewhere.

Asheville in Motion. Adopted in 2016 and developed with participation from NCDOT Division 13, the Asheville in Motion (AIM) plan sought to integrate the City's past transportation efforts into a single document. Merrimon is designated to have bike lanes as part of the city's proposed system of secondary bicycle routes. It is also shown to be a corridor for premium bus services. These designations indicate the City views Merrimon as a street that serves transportation functions beyond motor vehicle speed and volume, as its City Connector designation suggests. This supports reconfiguring it to serve other modes more safely and conveniently than it does in its current configuration. (5)

Figure 2: Merrimon Avenue identified as City Connector in Asheville in Motion Plan.



Comprehensive Plan. The City's Comprehensive Plan (6) echoes the goals and objectives of the Asheville in Motion Plan, with notable sections on increasing access to safe bicycling and making streets walkable. Its vision states:

- **Transportation and Accessibility:** Whether you drive a car, take the bus, ride a bike or walk, getting around Asheville is easy. Public transportation is widespread, frequent, and reliable. Sidewalks, greenways, and bike facilities get us where we want to go safely and keep us active and healthy. It is easy to live in Asheville without a car and still enjoy economic, academic, and social success. (page 59)

Page 151 of the Themes document notes: "Where feasible, the preferred method is to provide buffered bike lanes or, bike facilities physically separated from vehicular traffic...Identify and pursue major corridor-level retrofits and upgrades for bicycle infrastructure and connectivity."

FBRMPO Supporting Actions

The French Broad River MPO is the federally-designated transportation planning organization for the Asheville region. Much like the City's planning efforts, FBRMPO's plans also provide ample support for the roadway reconfiguration of Merrimon.

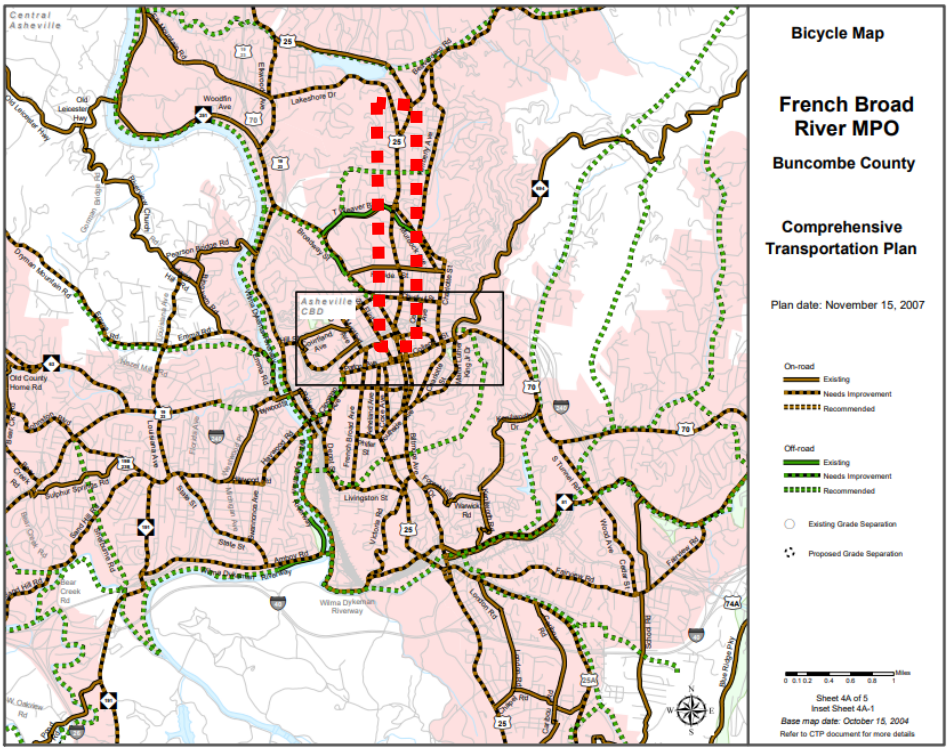
Complete Streets Policy. Adopted in February 2013, the MPO's policy states, "FBRMPO will seek incorporation of the Complete Streets concept and policy into the development of all transportation infrastructure within the region at all phases of their development, including planning, scoping, design approvals, implementation, and performance monitoring." It also states the MPO purpose with regard to the City's plans and NCDOT's Complete Streets policy:

- "To act in concurrence with North Carolina Department of Transportation Complete Streets Policy and any locally-adopted Complete Streets policies and transit, bicycle and pedestrian plans." (7)

Comprehensive Transportation Plan. The 2008 CTP set forth many of the current efforts for the FBRMPO with its designation of Merrimon Avenue as "Needs Improvement" from a bicycling perspective (page 55; Figure 3). The plan notes Merrimon Avenue as a lower priority when it comes to motorist-based highway investments (page 87; 2-3), denoting it may need spot intersection improvements such as turn lanes. (8)

Metropolitan Transportation Plan 2045. The MTP includes a Horizon Year 2040 project that specifically denotes application of a road reconfiguration on Merrimon Avenue, with an estimated cost of $10.89 million (page 89). This is consistent with the goals of the MTP, including the first goal listed in the MTP to "Improve Multimodal Transportation" through improving "bicycle and pedestrian safety," increasing "utilization of other modes," and improving "multimodal network connectivity." The second goal is to

Figure 3: FBRMPO Comprehensive Transportation Plan Bicycle Map



"improve safety." (page 20). Specifically, the FBRMPO MTP outlines objectives that support the Merrimon Avenue reconfiguration:

- Increase the miles of bicycle infrastructure to make bicycling a safer, more attractive way of making trips.
- Increase the number of trips made by transit, biking, and walking.
- Improve first/last mile connections for transit users.
- Improve connectivity of pedestrian and bicycle infrastructure. (9)

Congestion Management Process. The Vision for this 2018 plan states, "The FBRMPO will promote a safe and efficient transportation system that increases transportation options and enhances the environment and livability of the region through a well-integrated roadway, transit, rail, pedestrian, and bicycle network." It also states the MPO desires to "Improve multi-modal and non-motorized transportation options" and "Improve safety on surface streets and highways."

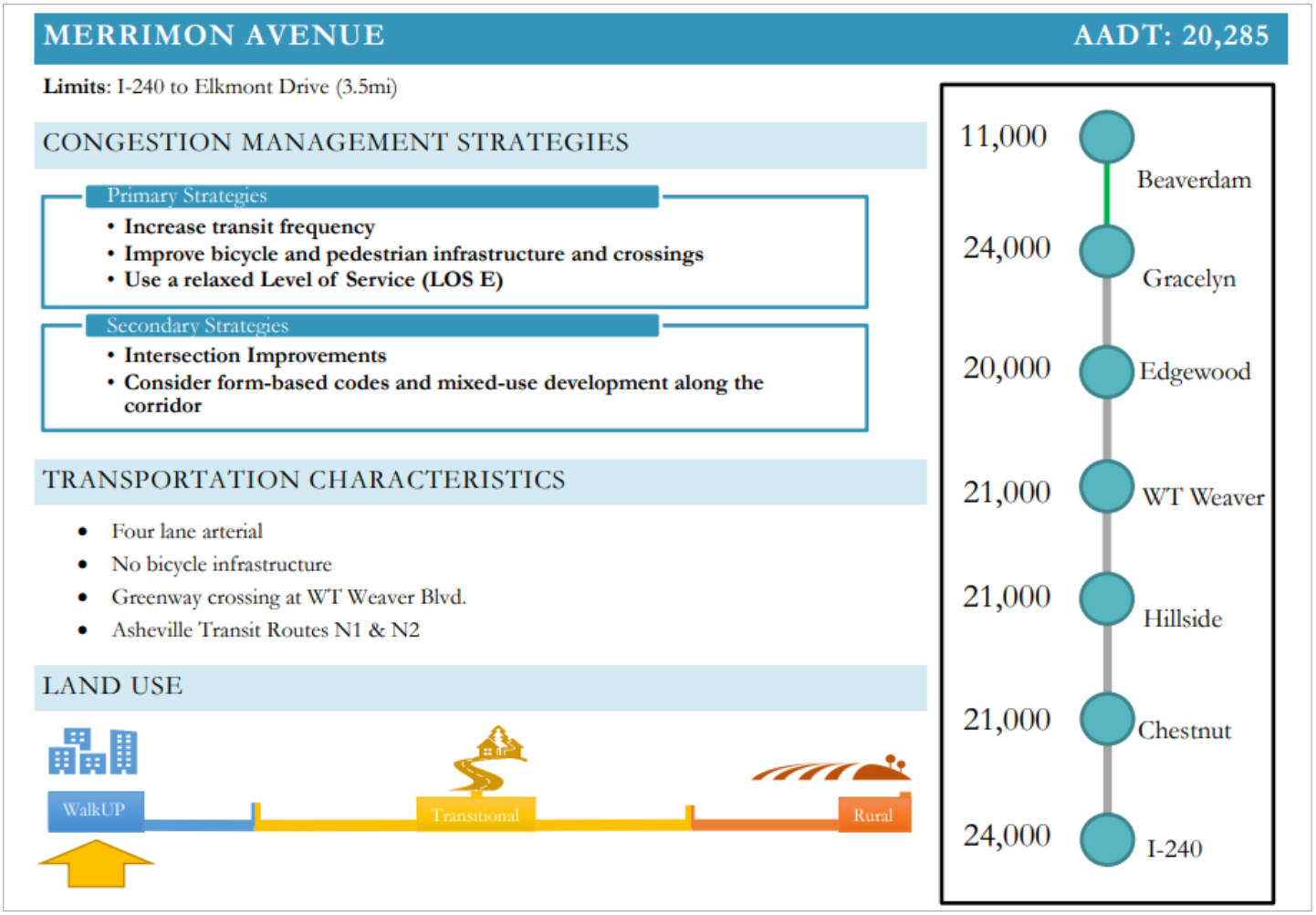
That bicycle network element is supported for Merrimon Avenue, as shown in Figure 4. It denotes Merrimon should have improved bicycle and pedestrian infrastructure and crossings, and **should have a relaxed Level of Service consideration in order to achieve this.** The CMP mirrors the CTP with Merrimon, showing spot operational improvements (e.g. turn lanes) for vehicle traffic. (11)

NCDOT Supporting Actions

As noted above, NCDOT Division 13 staff and its then-NCDOT Board of Transportation Bicycle Committee representative for Division 13 and 14, participated in the process to designate Merrimon for a road reconfiguration project in the City's Comprehensive Bicycle Plan. That plan was reviewed and formally endorsed by NCDOT's Division of Bicycle and Pedestrian Transportation. NCDOT has also been involved on the other supporting actions and plans from the City and FBRMPO. The Merrimon Avenue reconfiguration is fully supported by both these past actions and the following policies and plans endorsed by NCDOT.

Mission. NCDOT's mission is: Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina." With a focus on people instead of automobiles,

Figure 4: FBRMPO Congestion Management Process Corridor Profile for Merrimon Avenue



as well as understanding people who bike need to get places safely and efficiently, the Merrimon project fits within its mission.

Context Sensitive Solutions. In the early 2000s, NCDOT embarked on what became a predecessor to current Complete Streets and Vision Zero/Safe Systems strategies. The effort known as Context Sensitive Solutions (CSS) or Context Sensitive Design. The purpose of NCDOT's Context Sensitive Solutions (CSS) *Goals and Working Guidelines* stated it was to:

- "Provide a framework to implement the Context Sensitive Solutions training with the ultimate goal of an infrastructure that provides safe and effective transportation while preserving and enhancing where possible the natural and human environment." (12, page 1)

Further, it supports the process used to reach the recommendation for a Merrimon reconfiguration, most notably the stated values of the City of Asheville and FBRMPO:

- "NCDOT employees will be the focal point for the human environment needs as we provide transportation infrastructure to our customers. We will solicit input from all stakeholders in every way needed to ensure all relevant needs are addressed and answers are provided to the suggestions and questions. Seeking first to understand the values and interests of the communities and genuinely evaluating the input prior to pre-judging their responses." (12, page 1-2)

Finally, NCDOT notes in its CSS *Goals and Working Guidelines* that the agency would (emphasis added): "Understand how to use the AASHTO Design Guide and its fullest range of options to **achieve maximum flexibility in design**." This concept of flexibility is noted in the section on FHWA support.

Complete Streets. Originally adopted in 2009 and updated in 2019, NCDOT's Complete Streets policy aspires to create conditions where the agency provides facilities for all users of all ages and abilities on the state's routes. The primary language from that policy is shown below in Figure 5. (13)

The accompanying *Complete Streets Planning and Design Guidelines (14)* from 2012 supports road reconfigurations through:

Figure 5: NCDOT's Complete Streets Policy

Definitions:

Complete Streets is North Carolina's approach to interdependent, multi-modal transportation networks that safely accommodate access and travel for all users.

Policy:

Transportation, quality of life, and economic development are all undeniably connected through well-planned, well-designed, and context-sensitive transportation solutions. To NCDOT, the designations "well-planned", "well-designed" and "context-sensitive" imply that transportation is an integral part of a comprehensive network that safely supports the needs of communities and the traveling public.

The North Carolina Department of Transportation, in its role as steward over the transportation infrastructure, is committed to:

- Enhancing safety for all transportation modes, in support of Vision Zero, a statewide program which aims to eliminate roadway deaths and injuries using data-driven prevention strategies;
- Providing an efficient multi-modal transportation network in North Carolina such that the access, mobility, and safety needs of motorists, transit users, bicyclists, and pedestrians of all ages and abilities are safely accommodated;
- Caring for the built and natural environments by promoting sustainable development practices that minimize impacts on natural resources, historic resources, businesses, residents, scenic and other community values, while also recognizing that transportation improvements have significant potential to contribute to local, regional, and statewide quality of life and economic development objectives;
- Working in partnership with local government agencies, interest groups, and the public to plan, fund, design, construct, and manage complete street networks that sustain mobility through walking, biking, transit and driving.

This policy requires NCDOT planners and designers consider and incorporate multimodal facilities in the design and improvement of all appropriate transportation projects in North Carolina. Routine maintenance projects may be excluded from this requirement if an appropriate source of funding is not available. Consideration of multimodal elements will begin at the inception of the transportation planning process and the decisions made will be documented.

- Street conversions or road diets by restriping and reassigning lanes (page 142)
- Pavement restriping (similar to maintenance projects): Convert streets or use road diets to provide a full bike lane; Reduce lane widths to provide a full bike lane. (page 144)

On its Complete Streets website, NCDOT showcases other road reconfiguration projects implemented in North Carolina (Figure 5). This includes the East Boulevard Road Diet in Charlotte, which has similar characteristics to what is proposed on Merrimon (see page 30).

Figure 5: Road Diets Profiled for NCDOT's Complete Streets Effort

Road Diet

West Morehead Streetscape Project

As development along West Morehead Street in Charlotte slowly changed from industrial to retail and commercial uses, the need to improve conditions for bicyclists and pedestrians became more apparent. Working with NCDOT and other partners, the City of Charlotte reduced the number of travel lanes from four to three while adding bicycle facilities and making improvements to intersections for pedestrians. The streetscape was also improved by adding street trees, decorative lighting and planting strips.

East Boulevard Road Diet

To address growing concerns among residents about the lack of safe crossing locations despite high numbers of pedestrians and a variety of destinations, the City of Charlotte conducted a three-phase road diet along a section of East Boulevard. After a challenging construction period between 2005 and 2011, the resulting roadway has seen reductions in all crash types, lower motor vehicle speeds and improved access for all road users.

Hillsborough Street Revitalization

Pedestrian safety concerns, lack of parking, and motor vehicle congestion plagued the Hillsborough Street corridor adjacent to NC State University. NCDOT and the City of Raleigh, in cooperation with a coalition of business owners and residents, implemented a road diet and streetscape improvement resulting in an improved corridor for all users.

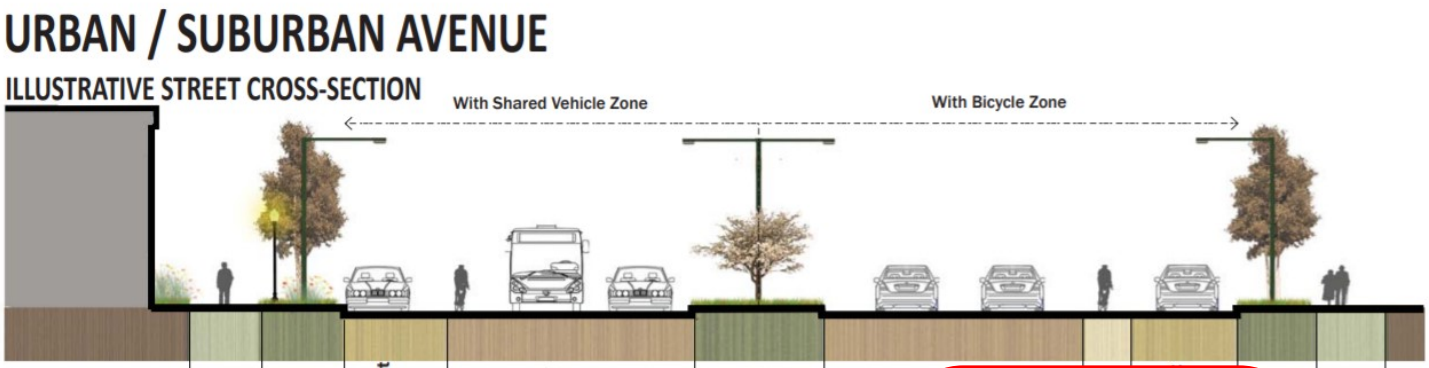
https://www.completestreetsnc.org/project-examples/

The illustrative street cross sections in the NCDOT *Complete Streets Planning and Design Guidelines* bolster support of what is proposed for specific design elements on Merrimon Avenue. The overall guide includes several design treatments, including bike lanes and 10-ft wide motor vehicle lanes as suitable design options for avenues (Figure 6 below; page 75).

Roadway Design Manual. NCDOT updated its roadway design manual in 2021. Chapter 4 of that manual addresses Cross Section Elements and provides design support for both what is proposed by the City and NCDOT on Merrimon, as well as support for consideration of the additional cross section features recommended in this assessment for AOB. Specifically:

- **4.3 Lane Widths (page 4-1):** Lane widths for arterials range from 10 to 12 feet. On high speed, free flowing urban arterials, 12-foot lanes are preferred. When truck and bus traffic is low and speed is less than 35 mph, 10-foot lane widths may be used.
- **4.15.3 Bicycle Lanes (page 4-33)**: Desirable width – 6 to 7 feet, especially adjacent to on-street parking; Minimum width – 5 feet, not inclusive of gutter pan.

Figure 6: NCDOT Complete Streets Planning and Design Guidelines, Urban/Suburban Avenue



STREET COMPONENT DIMENSIONAL GUIDELINES

	Sidewalk Zone (feet)	Green Zone (feet)	Parking /Transit Zone (feet)	Motor Vehicle/ Shared Vehicle Zone (lane width- feet)	Bicycle Zone (feet)	Access Zone (feet)
Central Business District	8' - 12' 12' - 20' in high volume pedestrian areas	6' - 8'	8' - 10'	10' - 11' (see notes 4 & 5)	4' - 6' lanes (see notes 4, 5 and 6)	0' - 17'6" (see note 7)
Urban Center / Suburban Center	6' - 10' 12' - 20' in high volume pedestrian areas	6' - 8'	8' - 10'	10' - 11' (see notes 4 & 5)	4' - 6' lanes (see notes 4, 5 and 6)	0' - 17'6" (see note 7)
Suburban Corridor Urban Residential / Suburban Residential	6' - 8' 12' - 20' in high volume pedestrian areas	6' - 8'	8' - 10'	10' - 11' (see notes 4 & 5)	4' - 6' lanes (see notes 4, 5 and 6)	0' - 17'6" (see note 7)

- **4.15.4 Buffered Bicycle Lanes (page 4-33)**: A buffered bicycle lane is a bicycle lane separated from the adjacent traffic lane and parking by longitudinal pavement markings. The buffer area might include chevron or diagonal markings, typically at least 2 feet wide. Use this type of facility when a separated bicycle lane is desired but not feasible. (15)

Vision Zero. The 2019 Complete Streets Policy update includes a reference to Vision Zero, which is a policy NCDOT adopted in 2015. It states, "The Vision Zero strategy establishes a long-term vision of zero fatalities on North Carolina roadways through sustained efforts in engineering, enforcement, education, emergency response, and public policy." (16)

In 2020, nearly 17% of traffic deaths in North Carolina were someone who was walking or bicycling (17). Strategies like those proposed for Merrimon would address some of the key causes of these deaths, which are shown in nationwide research to be: The speed of a motorist, lack of dedicated facilities, lack of protected facilities, and lack of safe crossings.

FHWA has pivoted from using the term Vision Zero and now uses Safe Systems (see page 11) to showcase these needed safety interventions set forth in NCDOT's Vision Zero policy.

Walk Bike NC. The statewide bicycle and pedestrian plan was adopted by the NCDOT Board of Transportation in December 2013. Called WalkBikeNC, the plan "lays out a framework for improving bicycle and pedestrian transportation as a means to enhance mobility, safety, personal health, the economy, and the environment." The plan includes sections on these various topics and references prevailing federal pedestrian and bicyclist design guidance in place at the time of adoption. The plan include a design toolbox with road reconfigurations mentioned as a way to decrease crossing distances on roadways for pedestrians. This is most notable in terms of accessing transit and being able to more safely cross a street.

The environment chapter of WalkBikeNC acknowledges the benefits of increased walking and bicycling in terms of reducing greenhouse gas emissions. (18)

Figure 7: Section from WalkBikeNC Design Guidance

Road Diet for decreased crossing distance: Roadway narrowing can improve conditions and safety for pedestrians by decreasing vehicle speeds and the distance pedestrians have to travel to cross the street. Roadway narrowing can be achieved by narrowing vehicle lanes, removing travel lanes, adding on-street parking, or other means.

Transportation-Health Policy. In 2012, the NCDOT Board adopted a Transportation-Public Health Policy (19), which is referenced in the WalkBikeNC plan. This policy acknowledges "Inactivity among North Carolinians has contributed to higher rates of chronic diseases, lower levels of overall health and well-being, and therefore higher health care costs. It then states:

- The North Carolina Department of Transportation may have opportunities to support positive health outcomes by considering public health implications in our decision-making across all transportation modes, programs, policies, projects, and services, and through all stages of the life of a transportation project from planning to project development, construction, operations, and maintenance. Specifically, we can consider:
    - A multi-modal transportation system to provide access to and options for customers of all abilities and capabilities;
    - The safety for all users and all modes of transportation; and
    - The potential for the transportation system to support human health.

Executive Order 246, Greenhouse Gases, & Climate Science Report. On January 7, 2022, NC Governor Roy Cooper signed this executive order stating the 2020 North Carolina Climate Science Report "found that adverse impacts of climate change in North Carolina threaten human health, the State's economy, and our quality of life." That Executive Order also states, ", all North Carolinians,

irrespective of economic status, cultural heritage, race, religion, or zip code, have the right to enjoy a sustainable environment with clean air, clean water, and clean soil and that is free from environmental injustice." This aligns with the environmental themes adopted within WalkBikeNC.

The Merrimon reconfiguration supports these statements, as well as the order for NCDOT to develop a Clean Transportation Plan that shall address (emphasis added):

- Increased availability, sales, and usage of ZEVs to levels beyond current market projections; **reductions in vehicle miles traveled**; investment in clean transportation infrastructure; **equitable access to clean mobility options**; **increased availability of non-vehicle transportation modes**; a transition to zero- and low-emission fuels; and other relevant topics. (20)

Federal Highway Administration Supporting Actions

FHWA provides substantial guidance and support for roadway reconfigurations like the one proposed for Merrimon Avenue. FHWA does this through endorsement of various design guides and policies that collectively support efforts such as Vision Zero (Safe Systems), NCDOT's Context Sensitive Solutions, Complete Streets, and other published policies. This section provides a summary of those policies and design guides.

Vision Zero/Safe Systems. The United States leads the world's wealthy nations in traffic deaths. The emerging science is showing that these are the results of a lack of system-level efforts to reduce deaths. For roadway design, it means understanding that humans make mistakes when driving, walking, or bicycling. Too many of today's streets, Merrimon included, are engineered so that the slightest mistake can result in a road user's death. The Yvonne Coleman death while walking across Merrimon showcases this. Regardless of the type of mistake made by the victim or the driver, FHWA's Zero Deaths and Safe System approach is founded:

- "The principles that humans make mistakes and that human bodies have limited ability to tolerate crash impacts. In a Safe System, those mistakes should never lead to death. Applying the Safe System approach involves anticipating human mistakes by designing and managing road infrastructure to keep the risk of a mistake low; and when a mistake leads to a crash, the impact on the human body doesn't result in a fatality or serious injury. Road design and management should encourage safe speeds and manipulate appropriate crash angles to reduce injury severity." (21)

Merrimon's current design means that the mistakes that people make when using it have a higher likelihood of resulting in a death or disabling injury. A bicyclist attempting to use the route may be sharing a lane with a much faster and larger motor vehicle. A slight move or fall by the bicyclist or a veering out of the adjacent lane by a motorist could result in death. Ms. Coleman's death could have been mitigated with more frequent and safer crossings, as well as safer speeds along Merrimon.

Bicycle and Pedestrian Facility Design Flexibility. The approved set of guides adopted by FHWA support the Safe System approach, including several national design guides for bicyclist and pedestrian facility design. On August 20, 2013, FHWA issued a memorandum titled "*Bicycle and Pedestrian Facility Design Flexibility*." In it, they endorse several publications from AASHTO, NACTO, and ITE, stating "FHWA supports the use of these resources to further develop nonmotorized transportation networks, particularly in urban areas." It cites a 2010 USDOT policy statement that aligns with many of the same themes highlighted in NCDOT's adopted policies and guides:

- "DOT encourages transportation agencies to go beyond the minimum requirements, and proactively provide convenient, safe, and context-sensitive facilities that foster increased use by bicyclists and pedestrians of all ages and abilities, and utilize universal design characteristics when appropriate." (22)

Road Diet Informational Guide. Contrary to popular belief, there is no FHWA policy or standard by which a road reconfiguration should be considered or determined infeasible. Oftentimes, opponents of road diet/road reconfigurations cites motor vehicle traffic thresholds to make a case against reconfiguring 4 lanes to become 3 lanes.

FHWA Road Diet Information Guide, Section 3.3.5—Average Daily Traffic, states:

- "The ADT provides a good first approximation on whether or not to consider a Road Diet conversion. If the ADT is near the upper limits of the study volumes, practitioners should conduct further analysis to determine its operational feasibility. This would include looking at peak hour volumes by direction and considering other factors such as signal spacing, turning volumes at intersections, and other access points. Each practitioner should use engineering judgment to decide how much analysis is

necessary and take examples from this report as a guide. **A 2011 Kentucky study showed Road Diets could work up to an ADT of 23,000 vehicles per day (vpd)**. In 2006, Gates, et al. suggested a maximum ADT of between 15,000 and 17,500 vpd. Knapp, Giese, and Lee have documented **Road Diets with ADTs ranging from 8,500 to 24,000 vpd**. The FHWA advises that roadways with ADT of 20,000 vpd or less may be good candidates for a Road Diet and should be evaluated for feasibility...**Road Diet projects have been completed on roadways with relatively high traffic volumes in urban areas or near larger cities with satisfactory results.**"

Further, FHWA's guide dispels another myth that preserving some level of motorist level of service is a safety measures, which it is not. Section 3.3.3 on Level of Service (LOS) states: "Level of Service (LOS) is a qualitative measure of traffic conditions using a quantitative stratification of a performance measure or measures."

FHWA includes a section in this guide on Quality of Service factors when evaluating pedestrian and bicyclist experience on a route that is reconfigured.

- **Pedestrian LOS scores are likely to improve** due to the lane reduction, speed reduction, and the reallocation of traveled way width to bicycle lanes and on-street parking.
- **Bicycle LOS scores will improve as a result of some of the same factors, as well as the addition of a bicycle lane**.
- **Applying a Road Diet configuration on a corridor with frequent signalized intersections will have a larger impact on automobile operations than it would on a corridor with more infrequent signal spacing**. Frequently spaced signals are more likely to have queued traffic back up into adjacent signals' effective areas, causing congestion issues at multiple intersections. In some cases this impact can be mitigated by optimizing the signal timing and coordinating between signals. The arterial automobile LOS will provide a more accurate view of conditions when there are longer distances between signalized intersections or only unsignalized intersections in the corridor.

Section 3.4.1 addresses Bicycle Considerations, most notably:

- "Whether or not there is existing activity, demand for a bicycle facility should be estimated. In cases where there are already bicycle facilities, a Road Diet may be an opportunity to further enhance the comfort of bicyclists by adding buffer space or converting a standard bicycle lane to a protected bicycle lane. Adding **buffers may have additional benefits to other users as well. For instance, where the goal is to lower speeds, adding buffers to narrow travel lanes may accomplish that, which would be a benefit to pedestrians as well as bicyclists."** (23)

AASHTO's A Guide for Achieving Flexibility in Highway Design. These statements from FHWA's *Road Diet Information Guide* are consistent with another federally-endorsed design guide, AASHTO's *Achieving Flexibility in Highway Design*. It was developed in the early 2000s as agencies like NCDOT were pursuing their Context-Sensitive Solutions efforts. (24)

Regarding concern over modeled level of service in 2045 on the Merrimon Avenue AECOM study, the flexibility guide states in Section 1.4.5 on Level of Service:

- "The AASHTO Green Book and many agencies provide general guidelines on design level of service for different conditions...**Failure to achieve a level of service indicated in [the Green Book LOS table] does not constitute a non-standard design decision.** Indeed, it is common practice in major metropolitan areas to routinely design for a certain levels of congestion (level of service D or E)...The Green Book includes discussion of the implications of and recommendations for designing for congestion, thus implying recognition of the practical problems associated with always providing a certain minimum level of service."

Regarding the 10-ft wide travel lanes proposed on Merrimon, AASHTO supports this in its flexibility guide, specifically in Section 3.6.1 on Lane Widths:

- "**In urban areas...narrower lane widths may be appropriate. For such locations, space is limited and lower speeds may be desired.** Narrower lane widths for urban streets lessen pedestrian crossing distances...and enable the development of left-turn lanes for safety. **Lesser widths also encourage lower speeds...In considering the use of narrower lanes, however, designers should recognize that narrow travel lanes reduce vehicle separation from other vehicles and bicyclists**." (page 64)

- "There is less direct evidence of a safety benefit associated with incrementally wider lanes in urban areas." (page 64)

Section 3.6.1.2 highlights the flexibility in the AASHTO Green Book, which is used extensively by agencies like NCDOT to develop their own design manuals. It states:

- "The AASHTO Green Book recognizes the need for flexibility and provides that flexibility, citing how lane widths can be tailored, to a degree, to fit the particular environment in which the roadway functions...**The discussion of lane width in the AASHTO Green Book for urban areas also reflects a high degree of flexibility. It is noted that lane widths 'may vary from 10 to 12 ft for arterials**." (page 65)

Finally, in terms of design speed for a future Merrimon reconfiguration, the AASHTO Flexibility Guide states: "Given the historic equating of design speed with design quality, the notion of designing a high quality, low speed road is counter-intuitive to some highway engineers. Yet it is in many cases the appropriate solution to a sensitive neighborhood or other street design problem. **Context-sensitive solutions for the urban environment often involved creating a safe roadway environment in which the drives is encouraged by the roadway's features and the surrounding area to operate at low speeds**." (page 19)

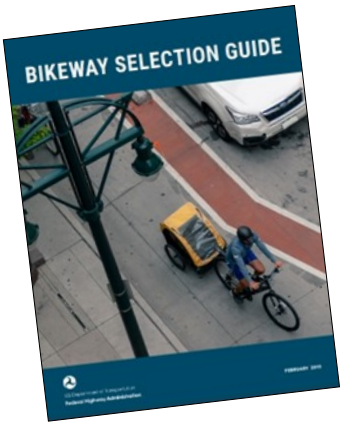
Figure 8: AASHTO Green Book Section on Target Speed

> Lower speeds are desirable for thoroughfares in walkable, mixed-use urban areas and this desire for lower speeds should influence the selection of the design speed. For design of such streets, a target speed should be selected (29). The target speed is the highest speed at which vehicles should operate on a thoroughfare in a specific context, consistent with the level of multimodal activity generated by adjacent land uses, to provide both mobility for motor vehicles and a desirable environment for pedestrians, bicyclists, and public transit users. The target speed is intended to be used as the posted speed limit. In some jurisdictions, the speed limit is established based on measured speeds. In these cases, it is important for the design of the thoroughfare to encourage an actual operating speed that equals the target speed (16, 35).

AASHTO Green Book. The concept of designing for a low speed environment is bolstered in the latest edition of the AASHTO Green Book, published in 2018. Section 2.3.6.3 on Design Speed includes the statement in Figure 8 on Target Speed. That is what is attempting to be achieved with the Merrimon reconfiguration. (25)

FHWA Bikeway Selection Guide. FHWA published this guide in 2019 to "help transportation practitioners consider and make informed trade-off decisions relating to the selection of bikeway types." It applies Safe System concepts pertaining to helping guard against fatal consequences of human error and contains guidance on the traffic conditions that should guide designers in determining the most appropriate type of bikeway on a particular street. Figure 9 shows the differences between a shared lane like Merrimon has today versus the proposed bike lanes that would come with a reconfiguration. It supports design treatments that

Figure 9: FHWA Bikeway Selection Guide



	Shared Lanes	Boulevards	Shoulders	Bike Lanes	One-Way Separated Bike Lanes with Mixing Zones	Separated Bike Lanes and Sidepaths with Protected Intersections
Functionality (Comfort) - Roads can be categorized by their function						
Lowest at higher vehicle speeds and volumes	✓	✓	✓	✓		
Highest at lower vehicle speeds and volumes	✓	✓	✓	✓		
Moderate to High due to separation from traffic and constrained entry point					✓	
High due to separation from traffic and constrained conflict point						✓
Forgiveness (Safety) - Infrastructure can be designed to accommodate human error						
Relies upon perfect user (driver and bicyclist) behavior to avoid crashes	✓	✓	✓	✓		
Minimal: bicyclists operating in shared space with vehicles	✓					
Moderate: application of traffic calming treatments and lower operating speeds can improve safety		✓				
Moderate: bicyclists operate in separated space from vehicles, however vehicles can encroach into the facility at any location			✓	✓		
Moderate: bicyclists operate in separated space from vehicles except for defined entry point, followed by shared operating space					✓	
High: bicyclists operate in separated space from vehicles except for defined conflict point which can be designed to reduce motorist speed, but contraflow movement from two-way operation can increase risk						✓

https://safety.fhwa.dot.gov/ped_bike/tools_solve/docs/fhwasa18077.pdf

make the target speed of Merrimon one that is low to increase comfort. Unprotected bike lanes have a moderate effect on safety since an error by a motorist means they can easily encroach upon the bike lanes. (26)

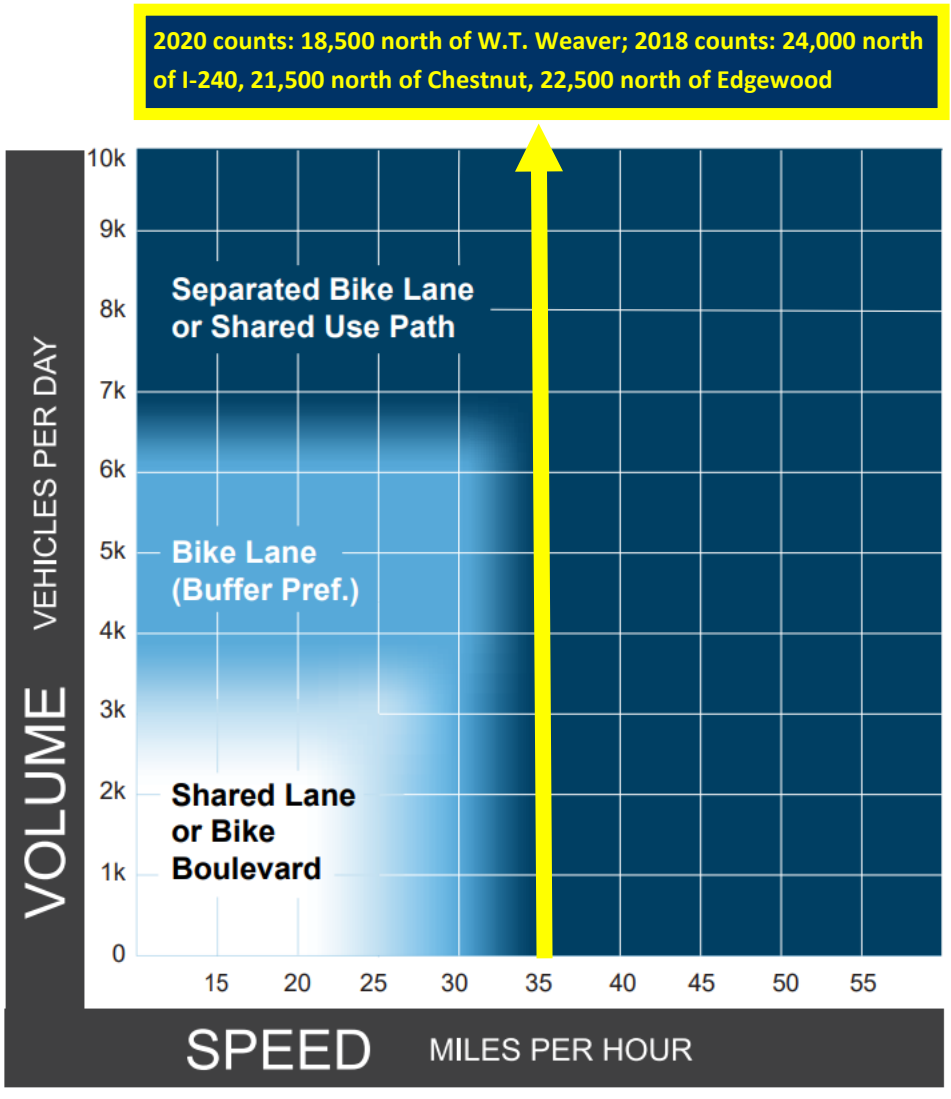
Figure 10 is a key element of that Bikeway Selection Guide. The matrix represents the preferred bikeway type for urban, urban core, suburban, and rural town contexts. The X-axis is where vehicle speeds are plotted against daily traffic volumes on the Y-axis.

Merrimon Avenue is literally "off the charts" when it comes to where it would plot on this map. Traffic volumes are in excess of 18,500 all along the route, which places the recommended bicycle facility in the category of a separated bike lane. The posted speed limit along Merrimon is 35 mph from I-240 to the north project limits, which also places it squarely in the category for warranting a separated bike lane.

These results showcase the justification for these key findings for the City and NCDOT to consider:

- **Shared Lanes (current):** Merrimon's current status clearly justifies some type of dedicated bike lane. Shared lanes are not sufficient from either a volume or a speed perspective.
- **Standard Bike Lanes (proposed),** like shown in the City and NCDOT proposed design, are not sufficient from a volume and speed perspective. Designing for a target speed of 30 mph would allow the standard bike lanes to be considered borderline if volumes were not a factor.
- **Buffered and Protected Bike Lane (preferred):** The cross sections proposed on pages 23-24 show how to accommodate a buffered and (somewhat) protected bike lane in 40-ft, 44-ft, and 48-ft curb-to-curb cross sections along Merrimon. These should

Figure 10: FHWA Bicycle Facility Selection Matrix with Merrimon Posted Speed & Volume

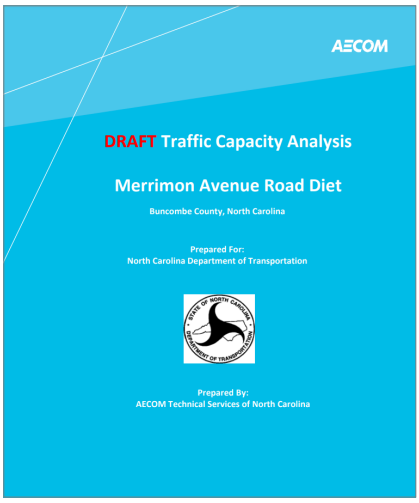


Source: Federal Highway Administration Bikeway Selection Guide

be considered in the design along with a target speed of 30 mph or less. This will help maximize usability of the corridor and maximize safety given the route's current constraints. (26)

Function & Safety

This section includes an evaluation of the Merrimon Avenue Road Diet Traffic Capacity Analysis conducted by NCDOT in 2021, as well as other background data and factors to consider. The NCDOT traffic capacity analysis for Merrimon Avenue evaluates conditions for motorists with no analysis of conditions for other users of the corridor.



Due to this omission of non-motorized analysis, this section also includes use of a Level of Traffic Stress tool that is recommended in the ITE Trip Generation Manual as being a more applicable method than bicyclist and pedestrian level of service methods contained in the Highway Capacity Manual methods and software utilized by NCDOT on the traffic capacity analysis.

NCDOT/AECOM Traffic Study. The northbound and southbound level of service results of the study were the focus of this assessment since they represent the conditions for motorists using Merrimon. East-west movements calculated in this study are for the side streets that intersect Merrimon and provide relatively minor function in the overall system (with the exception of W.T. Weaver Blvd). A level of service on these intersecting streets is likely more related to traffic signal timing preferences to prioritize movement on Merrimon. (27)

An indicator of this can be traced through the different alternatives for the Merrimon at Shopping Center Dwy/Ottari Road intersection. Westbound Left/Through/Right is modeled to be LOS E in 2019 and in every 2045 scenario evaluated (e.g. that congestion is not related to any road reconfiguration option).

If there is an interest to mitigate modeled congestion on these east-west legs, additional lanes may be added to them to allow for right or left turns. This may occur through requirements placed on redevelopment of the properties. However, such a requirement was not placed upon the Harris Teeter and Trader Joe's developments at Chestnut, which suggests neither NCDOT nor the City of Asheville were concerned with level of service on these east-west routes. Therefore, it is not a reason to suggest today that a road reconfiguration not be considered due to those same concerns.

Some notable elements of Merrimon's southbound and northbound trips are contained below where they are modeled to be at LOS E or F under any modeled scenario.

- **2019—Merrimon, southbound and northbound trips**
    - **Level of Service E or F:** Northbound and Southbound at I-240 ramps (PM peak only); Southbound left turns at Colonial/Gracelyn.
- **2045—Merrimon, No Build, southbound and northbound trips**
    - **Level of Service E or F:** Northbound and Southbound at I-240 ramps.
- **2045—Merrimon, Build Alternative 1 (Road Diet), southbound and northbound trips**
    - **Level of Service E or F:** Northbound and Southbound at I-240 ramps; Southbound left at Colonial/Gracelyn; Southbound left at Osborne/Beaverdam;
- **2045—Merrimon, Build Alternative 2 (Broadway connector; No Road Diet), southbound and northbound trips**
    - **Level of Service E or F:** Northbound left at Shopping Center Driveway (Harris Teeter); Southbound left at Colonial/Gracelyn.
- **2045—Merrimon, Build Alternative 3 (Broadway connector; With Road Diet), southbound and northbound trips**
    - **Level of Service E or F:** Southbound left at Chestnut; Southbound left at Hillside (AM peak only); Northbound left and Southbound through/right at Weaver; Southbound left at Colonia/Gracelyn; Southbound left at Osborne/Beaverdam (PM peak)

Figure 10: FHWA Bicycle Facility Selection Matrix with Merrimon Posted Speed & Volume

Table 6
Segment Analysis - Level of Service Summary

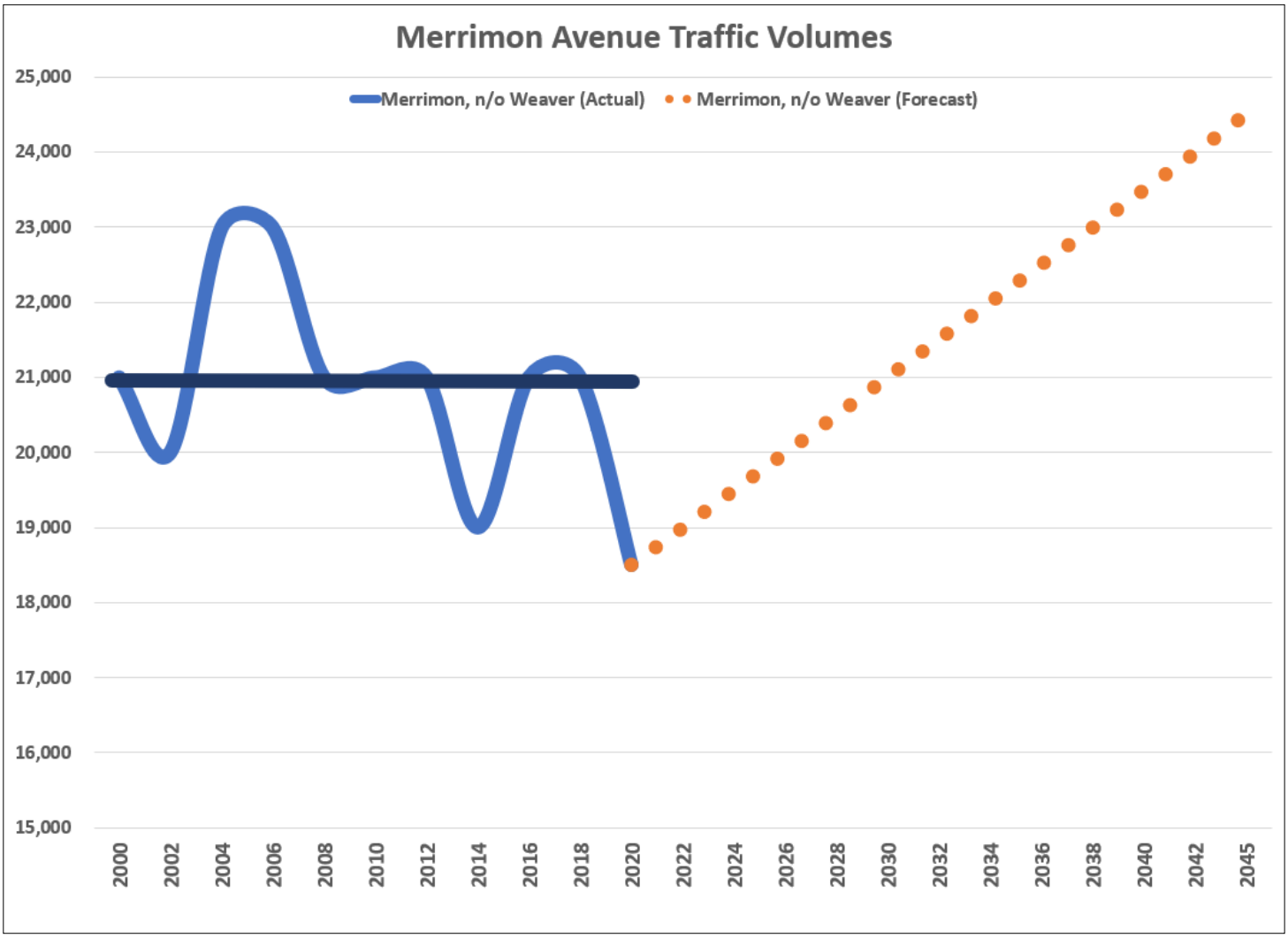
Route	Segment	2019 No Build	2045 No Build	2045 Build 1	2045 Build 2	2045 Build 3
Charlotte St	South of I-240	B	F	F	F	F
	I-240 to Break	B	D	E	F	F
	Break to Hillside St	B	B	C	B	C
	North of Hillside St	B	B	B	B	B

Therefore, this assessment's findings are consistent with the City and NCDOT recommendations:

- **The proposed road reconfiguration is not a major influence on motorized traffic level of service under either scenario.**
- **Additionally, any modeled changes to traffic on Charlotte Street due to people choosing it over Merrimon is negligible (see Figure 10, next page).**

Traffic Counts—Historic vs. Projected. There is even greater cause for optimism for those concerned with traffic forecasts and projected delays along Merrimon in the future—with or without a road reconfiguration. Figure 11 plots NCDOT traffic counts and the AECOM traffic study for Merrimon at a location just north of W.T. Weaver Boulevard. Despite traffic counts that show volumes are steady or declining on Merrimon, the traffic forecast to 2045 still shows growth if Merrimon remains in its current configuration. It is not explained in the traffic study how 20 years worth of data showing a downward trend line in traffic could result in a 20

Figure 11: Merrimon Traffic Volumes: 2000-2020 Actual vs. 2020-2045 Forecast



-year growth forecast showing a 28.5% increase in traffic over a trend that shows volumes around 21,000 and maintaining. The modeled volumes in the AECOM study show 2045 volumes of close to 24,500.

This is likely the result of simply plugging in FBRMPO growth assumptions without verification of that growth or if it can even occur. The likely reason for Merrimon maintaining traffic volumes around 21,000 for the last 20 years is that the corridor has reached a functional capacity, which reflects reality more than a modeled demand represented in the AECOM study.

Weaverville/Woodfin Growth. The traffic volumes remaining relatively constant along Merrimon have occurred while there has been notable growth in Woodfin and Weaverville. From 2000 through 2020, the combined populations of Woodfin and Weaverville grew by 28%, or nearly 2,400 people to 10,900. Despite that growth, as well as growth in other Census tracts in unincorporated Buncombe County north of Asheville, the traffic volumes on Merrimon have remained close to 21,000. (Figure 12)

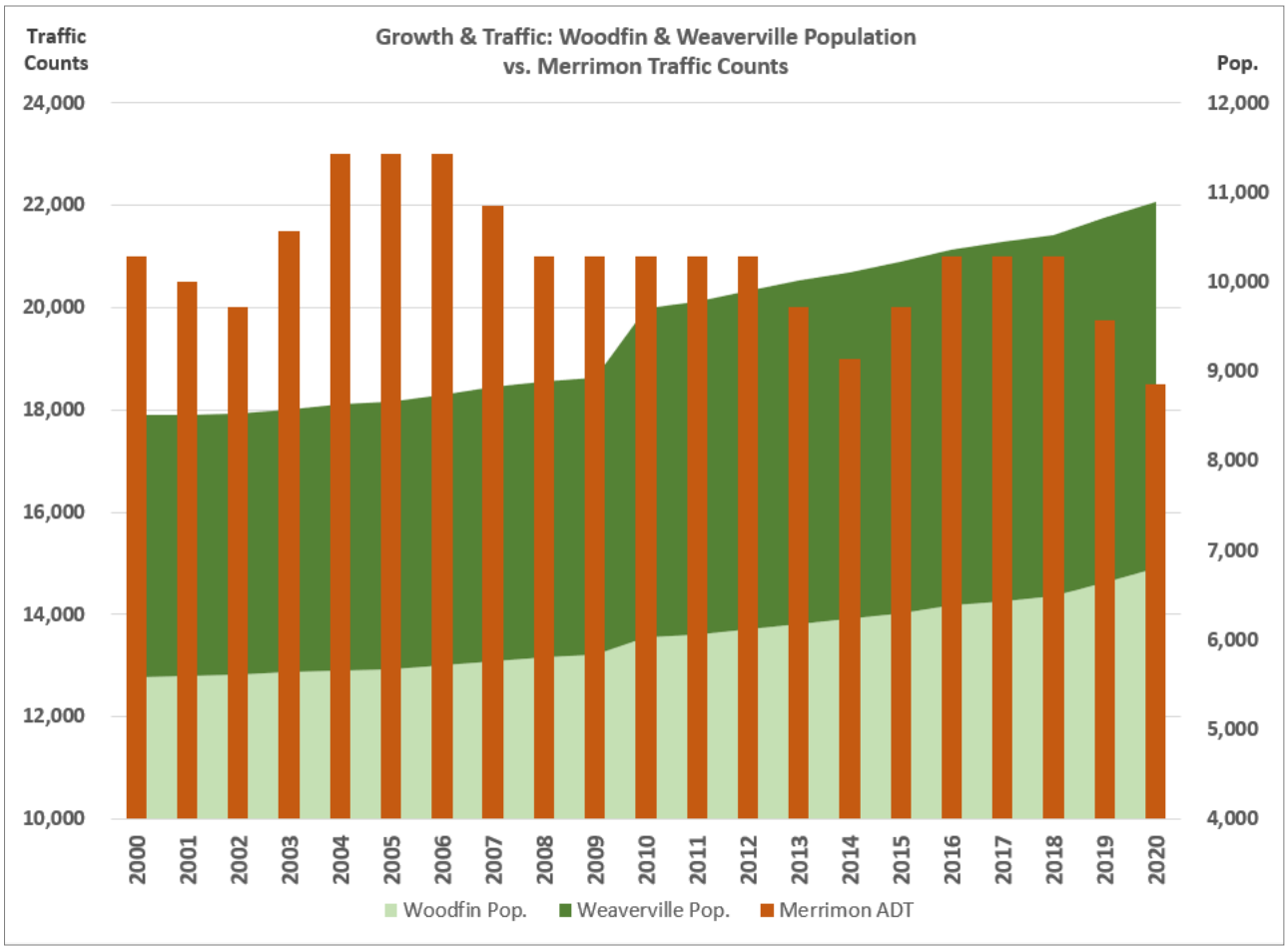
This supports the theory that Merrimon has reached a functional capacity and that people are either finding other routes to get to Asheville or bypassing the City altogether for jobs and shopping elsewhere along the I-26 corridor.

Either way, claims that Merrimon must remain in its current status or be widened to accommodate more traffic based on projected growth in Woodfin and Weaverville is not supported by history.

National Highway System Designation & NCDOT Priorities. Figure 13 on the following page shows the area of north Asheville from NCDOT's online map of National Highway System (NHS) routes. Despite being designated as US Highway 25, Merrimon is not part of the NHS. Interstates 26, 240 and 40 are part of the NHS as are Patton Avenue. Instead of Merrimon, Broadway is instead designated as the route from Future I-26 to I-240, where it then transitions to US 25 south of I-240 and continues through downtown to McDowell Street and to the south. NHS routes are typically subject to greater scrutiny by Federal Highway Administration when it comes to things like vehicle throughput and level of service due to their role in the greater transportation system for the country.

Since Merrimon is no longer part of the NHS, there is little justification to preserve it for current or future vehicle throughput, al-

Figure 12: Growth & Traffic—Woodfind & Weaverville Population vs. Merrimon Traffic Counts



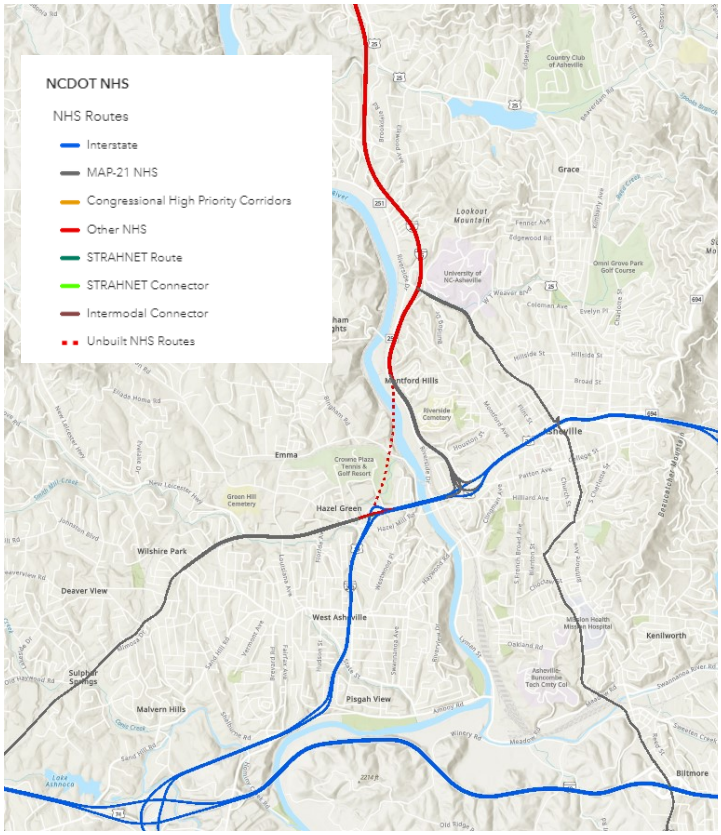
lowing the City of Asheville to realize its vision for Merrimon. Adding to this lessened importance is NCDOT's offering to the City of Asheville to have the City assume responsibilities for all facets of Merrimon, not just its sidewalks. If Merrimon were a corridor of strategic statewide significance, then it stands to reason that NCDOT would not have been so willing to give the corridor to the City of Asheville. Unfortunately, the state of North Carolina does not provides cities with ample tools and funding opportunities to take routes that are burdensome to NCDOT and transition them to local control. The NHS status of Merrimon should be confirmed through the City, NCDOT, and FBRMPO.

Multimodal LOS Analysis. Neither pedestrian nor bicyclist level of service analysis was performed as part of NCDOT's traffic capacity analysis. The Highway Capacity Manual software used by firms like AECOM often include modules that use the same motorize traffic inputs, combined with observable in-the-field features or proposed designs, to help generate a level of service score for pedestrians, bicyclists, and transit riders.

It is unclear why NCDOT chose to not conduct this multimodal LOS analysis alongside its motorized traffic analysis.

The City of Asheville did perform a bicyclist level of service analysis, which is shown in Figure 14. It shows that the existing con-

Figure 13: NCDOT National Highway System Map of Asheville Area



Also: https://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/north_carolina/index.cfm

Figure 14: City of Asheville Bicycle LOS for Merrimon

Existing Conditions

Bicycle Level of Service for this road segment

Lanes per direction:	2
Outside lane width:	11 ft
Paved shoulder/bikelane width:	0 ft
Bidirectional ADT traffic volume:	21500 (veh/day)
Posted speed limit:	35 mph
Heavy vehicle percentage:	3%
FHWA's pavement condition rating:	4
% of segment with occupied on-street parking:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	4.41	D (3.51-4.50)	Moderately Low

Road Diet

Bicycle Level of Service for this road segment

Lanes per direction:	1
Outside lane width:	10 ft
Paved shoulder/bikelane width:	5 ft
Bidirectional ADT traffic volume:	21500 (veh/day)
Posted speed limit:	35 mph
Heavy vehicle percentage:	3%
FHWA's pavement condition rating:	5
% of segment with occupied on-street parking:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	3.21	C (2.51-3.50)	Moderately High

ditions along Merrimon are at a LOS D for people who bike, which aligns with a low compatibility score for people wishing to go by bike. The proposal to add unbuffered, unprotected bike lanes improves that compatibility to LOS C.

There are limitations to the existing LOS methods for bicyclists and critics will cite that it is developed around a single type of bicyclist and does not account for people who may be less confident bicyclists.

Level of Traffic Stress. Due to the limitations of level of service methods for pedestrians and bicyclists, the ITE Multimodal Transportation Impact Analysis for Site Development (MTIA) publication recommends Level of Traffic Stress (LTS) as a better measure. The outcomes of a LTS analysis are more easily interpreted by the public and relatable to bicyclists.

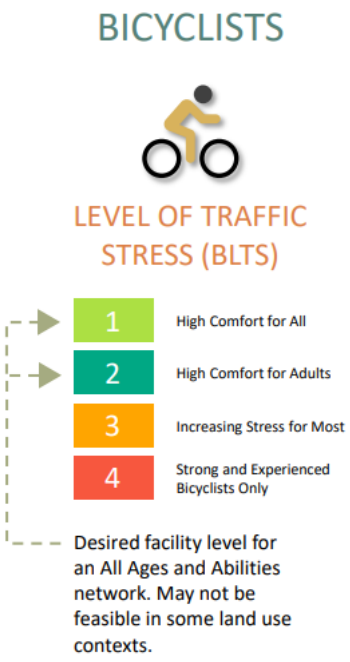


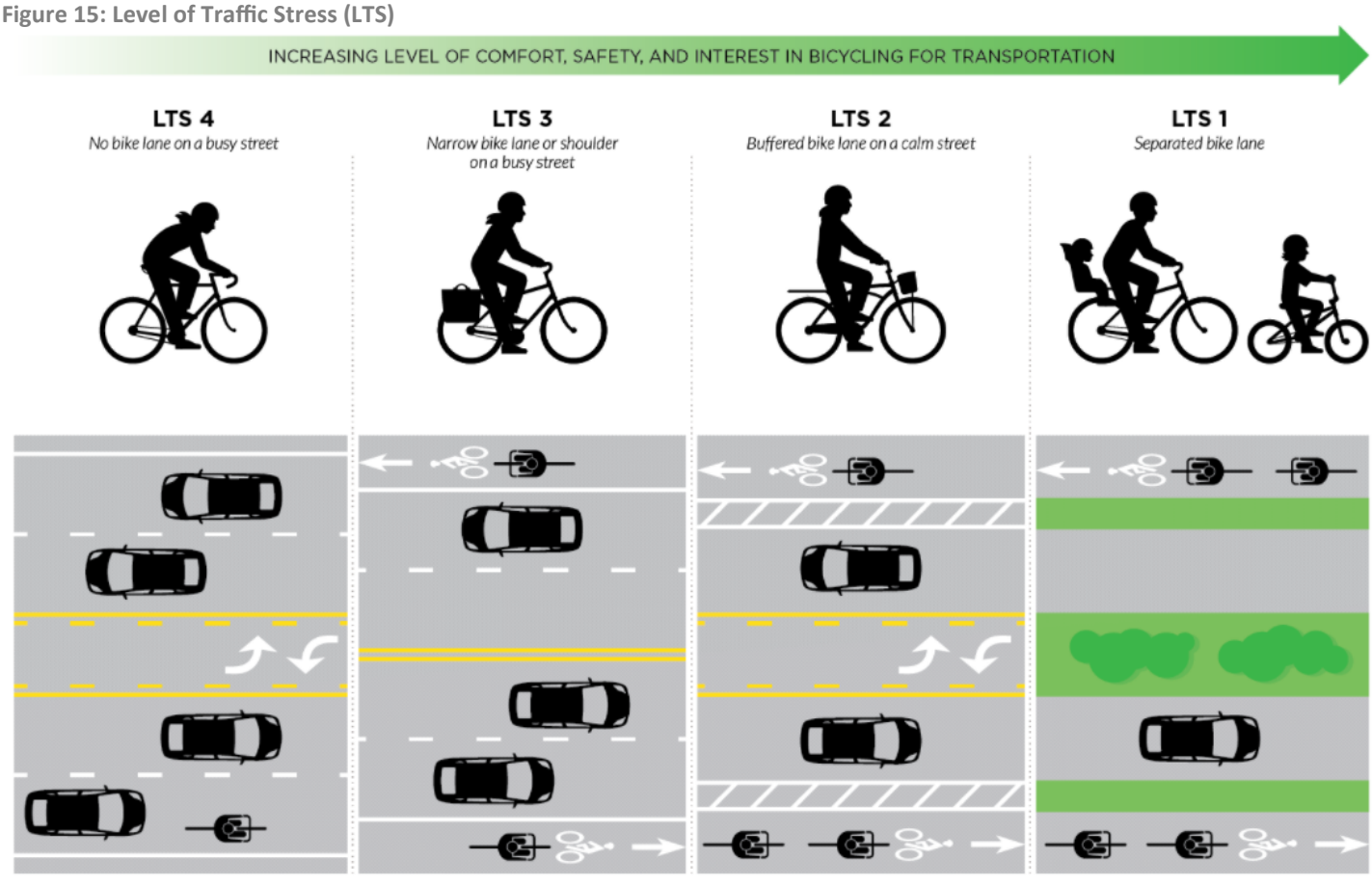
Figure 15 illustrates the concept of LTS as it relates to on-street facilities. A rating of LTS 4 (highest stress) means a route lacks bicycle lanes on a busy street, like with Merrimon. It is shown to be uncomfortable for most riders. A route with LTS 3 is similar to what is proposed on Merrimon with paint-only bike lanes and is shown to be comfortable for confident bicyclists with increasing stress for most.

A route with LTS 2, like could occur on Merrimon with buffered bike lanes, some type of vertical protection, and designing it for a target speed of 25 mph to 30 mph, would mean it is comfortable for most adults. A completely separated facility is LTS 1 (lowest stress) and is comfortable for all riders. LTS 1 is not likely attainable on Merrimon under any scenario.

Like with the bicycle LOS performed by the City that shows a change of one grade from LOS D to LOS C with the paint-only bike lanes, the LTS improvement is one grade from LTS 4 to LTS 3.

Figure 16 on the following page is a series of LTS measures generated by Alta Planning + Design for the Ada County Highway District in Boise, Idaho. It shows the deeper relationships between how to measure LTS as it re-

Figure 15: Level of Traffic Stress (LTS)



Source: Alta Planning + Design

Figure 16: Level of Traffic Stress (LTS), Adapted by Alta Planning + Design for Ada County Highway District

BIKE LANE AND BUFFERED BIKE LANES

Used in situations where there is a dedicated bike lane with or without a painted buffer. Bike lane width is measured exclusive of the gutter pan.

# of Auto Lanes	Bike Lane Width (Includes Buffer)	Posted Speed (Actuals When Available)						
		20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50+ mph
2-3	6'+	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4
	4' or 5'	LTS 2	LTS 2	LTS 2	LTS 2	LTS 3	LTS 4	LTS 4
4-5	6'+	LTS 2	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4
	4' or 5'	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4	LTS 4
6+	Any Width	LTS 3	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4

Adjustment Factors

- Heavily Utilized Parking Adjacent to a 4' or 5' Bike Lane – Add 1 LTS
- Roadway Pavement Condition Index Rating Below 70 – Add 1 LTS
- Frequent Commercial Driveway Crossings – Add 1 LTS

RAISED/PROTECTED LANES AND MULTI-USE PATHS

Used in situations where there are protected bike lanes or multi-use paths. For all segments (between intersections), these would be considered LTS 1.

Adjustment Factors

- Raised Bike Lanes At >35 MPH – Add 1 LTS
- Frequent Commercial Driveways – Add 1 LTS
- Bike lanes using only candles – Add 1 LTS

SIGNALIZED INTERSECTIONS AND ENHANCED CROSSINGS

Used in situations where there is a signal present. To rank, the highest stress score of any leg would be utilized.

Intersection Features	Total Auto Lanes Crossed At One Time		
	1-3	4-5	6+
Enhanced Crossing w/ Median Refuge	LTS 1	N/A	N/A
Protected Intersection or Enhanced Crossing (No Refuge)	LTS 1	LTS 2	LTS 3
Floating Bike Lane (Left of RTL)	LTS 2	LTS 3	LTS 4
Bike Lane (Right of RTL or Thru-Right Lane)	LTS 3	LTS 4	LTS 4

Adjustment Factors

- Refuge medians of at least 8' with a vertical element would reduce the total number of lanes crossed at one time to the distance from curb to median.

PEDESTRIANS

LEVEL OF TRAFFIC STRESS (PLTS)

1 High Comfort for All

2 High Comfort for Adults

3 Increasing Stress for Most

4 High Stress Experience

Desired facility level for an All Ages and Abilities network. May not be feasible in some land use contexts.

SIDEWALK BUFFER

Total Travel Lanes	Total Buffer Width (Includes Landscaping, Parking, Bike Lanes, etc)			
	<5'	5'-10'	11'-14'	15'+
1-2	LTS 2	LTS 2	LTS 1	LTS 1
3	LTS 3	LTS 2	LTS 1	LTS 1
4-5	LTS 4	LTS 3	LTS 2	LTS 1
6+	LTS 4	LTS 4	LTS 3	LTS 2

Adjustment Factors

- Low volume residential streets with 1-2 lanes – Lower 1 LTS
- Buffers for multi-use paths to be measured at centerline of the pathway.
- Buffers with street trees – Lower 1 LTS

SIDEWALK WIDTH AND CONDITION

Actual Sidewalk Width	Sidewalk Condition			
	Very Good	Good	Fair	Poor
<4'	LTS 4	LTS 4	LTS 4	LTS 4
4'	LTS 3	LTS 3	LTS 3	LTS 4
5'	LTS 2	LTS 2	LTS 2	LTS 4
6'+	LTS 1	LTS 1	LTS 2	LTS 3

Adjustment Factors

- Low volume residential streets with 4'-5' sidewalk – Lower 1 LTS
- 5' detached sidewalk in very good or good condition – Lower 1 LTS

lates to number of lanes and speed. Another LTS measure for bicyclists is having to cross routes like Merrimon to reach their destinations. This LTS measure should be incorporated into the design to determine the best crossing treatments.

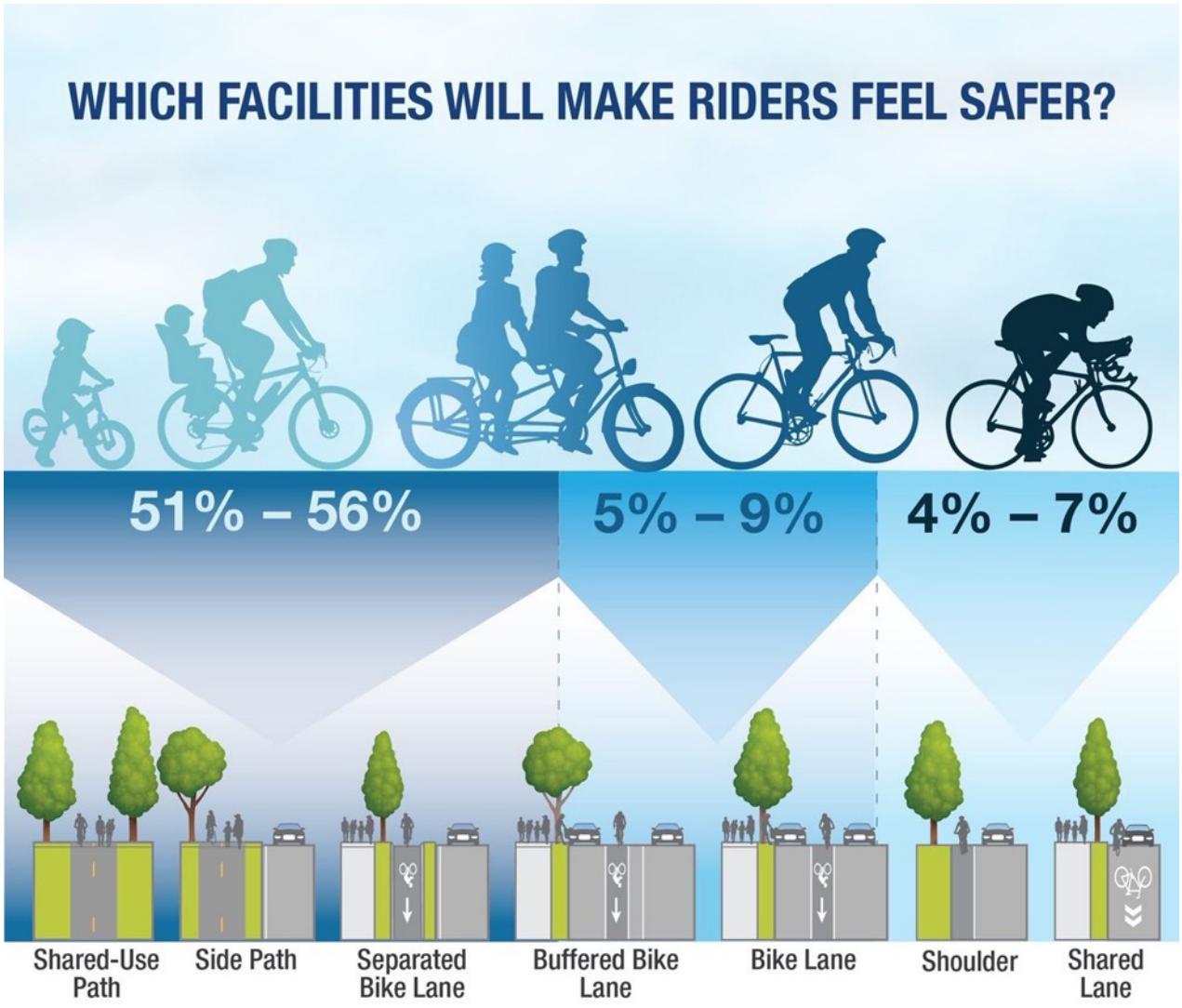
Additionally, the tables at the bottom of Figure 16 are LTS for pedestrians. The current sidewalks along Merrimon would place it in a range of LTS 4 under current conditions with the road reconfiguration moving it to LTS 3 due to a reduction in vehicle lanes. Project design should target LTS 2 or better, recognizing some improvements may have to occur through future redevelopment.

Cross Section Options for Merrimon

The FHWA Bikeway Selection Guide, referenced earlier, provides some diagrams on what types of facilities bicyclists will use and it indicates that paint-only bike lanes are desirable to a relatively small percentage of riders. Figure 17 shows that bike lanes or buffered bike lanes without protection will likely appeal to less than 10% of bicyclists. Creating a separated or protected bike lane has the most opportunity to see widespread change. NCDOT cites this guide for use as part of its *Roadway Design Manual* (15).

Given that, the realities of Merrimon Avenue are the corridor is largely built out from a land use perspective and any changes in the existing cross section, in terms of curb to curb space, would need to occur as properties redevelop. Moving curbing can be expensive due to impacts to stormwater conveyance. The cross sections on the following pages reflect the possibilities to deviate from

Figure 17: Which Facilities Will Make Riders Feel Safer



Note: Percentages represent the level of comfort that people feel bicycling, according to peer-reviewed surveys as recently as 2016.
Source: FHWA Bikeway Selection Guide: https://safety.fhwa.dot.gov/ped_bike/tools_solve/docs/fhwasa18077.pdf
For more information, please visit FHWA's Bicycle and Pedestrian Program webpage: https://www.fhwa.dot.gov/environment/bicycle_pedestrian/

the proposed cross section (see Figure 1 on page 4) to help improve LTS and take advantage of locations where the curb to curb section is greater than 40 feet in width.

Curb and Gutter. First, a concrete gutter pan must never be counted as bike lane width. The seam between asphalt and concrete at these locations creates unsafe conditions for bicyclists to navigate. The AASHTO Green Book notes that "a gutter of contrasting color or texture (black asphalt vs gray concrete) should not be considered part of the traveled way." NCDOT's Complete Streets Planning and Design Guidelines include footnotes in the cross sections that state:

- "The gutter pan is not considered part of the lane width or the bicycle lane width." (14)

The application of concrete gutters along Merrimon is inconsistent due to the piecemeal development that has occurred over several decades. The southern portions of the corridor under assessment have asphalt paved to the edge of the curb with no concrete gutter.

The images at right show the varying types of curbing present, even in short segments along Merrimon. Over time, repaving of Merrimon has also caused the roadway surface to be almost flush with the sidewalk in some areas, with little recognizable curbing. Given the scope of the Merrimon reconfiguration, the corridor is not likely to see a broad rebuild of the curbside environment to add continuous gutters.

In theory, even when there is no gutter pan, with asphalt placed right up to the curb, the outside foot or so tends to act as a gutter pan for stormwater flows during rain events. Given Asheville's frequent rain fall, it would be advised that Asheville on Bikes to go out during rain events to take images and videos of how water flows adjacent to the curb when there is no gutter pan. The flow of water adjacent to the curb must be considered if the bike lane is to be usable in year-round conditions. Leaving only 4 feet of width in the bike lane immediately adjacent to 10 ft wide travel lanes can pose some conflict for all road users.

Conceptual Cross Sections. All of this necessitates a very careful design process when determining dimensions for travel lanes and bike lanes within the corridor. The cross sections are developed based on three common widths along the corridor: 40 feet, 44 feet, and 48 feet. Any other sections can be adjusted from these.

NCDOT and City should be commended for developing conceptual cross sections for a 40-ft wide road surface that includes 10-foot travel lanes. While consistent with the AASHTO Green Book recommended widths for arterials, it is not a common practice, even among the most progressive cities and highway agencies. The reason for this is that wider vehicles, such as transit buses, firetrucks, and delivery vehicles, may have side mirrors that overhang the lane lines in 10-foot lanes.

Bike lanes of 5 ft, especially where there is no gutter pan, are also considered a minimum width due to lack of shy distance from the curbing, the speed of adjacent vehicles, and traffic volumes. Placing minimum travel lane

No gutter and street is almost level with the sidewalk.

Gutter starts and stops within the same block.

Gutter exists where recent development has rebuilt the street frontage.

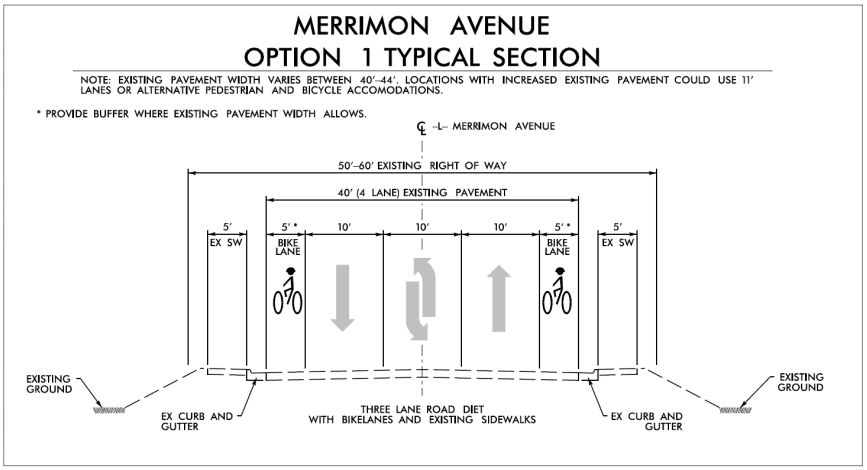
The gutter is not usable space for bicyclists and bike lanes should not be designed to include the gutter in the width calculations.

widths adjacent to minimum bike lanes in this situation is something that should be carefully considered.

The typical sections included in NCDOT's 2019 express design concepts show the typical 40 foot section, noting:

- "Existing pavement width varies between 40'-44'. Locations with increased existing pavement could use 11' lanes or alternative pedestrian and bicycle accommodations." (28; see Figure 18)

Figure 18: NCDOT Express Design Concept Cross Section



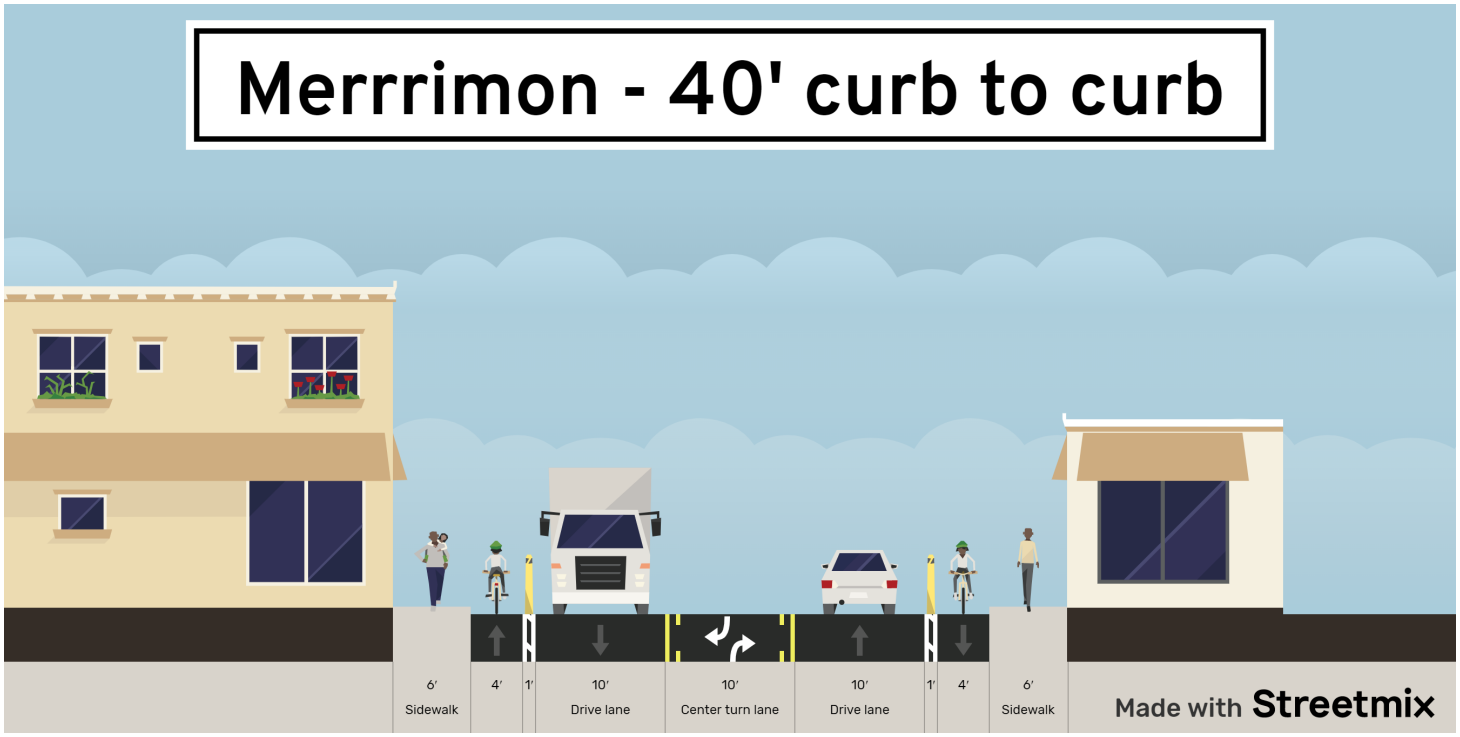
It is important to advocate that the final design cross sections follow a method of determining how the additional width beyond 40 feet is allocated.

As noted, the 10 foot wide lanes are notable and should be commended. Typically, the center turn lanes are the first place traffic engineers would prioritize adding width and that is reasonable on the Merrimon project.

However, after a center turn lane is made 11 feet in width, the next priority should be the bike lane and creation of a buffer between the outside travel lanes and the bike lanes. Figure 19 shows a 5 foot wide bike lane adjacent to a 10 foot wide travel lane on a heavily-traveled truck route that serves a landfill. The 1-foot wide painted buffer acts as a type of "neutral zone" to create shy distance from bicyclists and adjacent motorist. It also allows the vehicles that need additional space for mirrors

Figure 19: Buffered Bike Lane next to 10-ft wide Travel Lanes

Figure 20: Optional Cross Section with 40' from curb to curb



to have them overhang this space without allocating additional lane space to the majority of vehicles that don't need lanes wider than 10 feet.

Figure 20 shows how this same concept could be applied to the existing 40 foot cross section proposed by the City and NCDOT. Note, this may not be advisable if there is no gutter pan. A painted buffer would allow installation of some type of hard line delineator (see Figure 21) to provide some vertical presence between the travel lanes and bike lanes, which could increase safety and comfort for a wider variety of bicyclists.

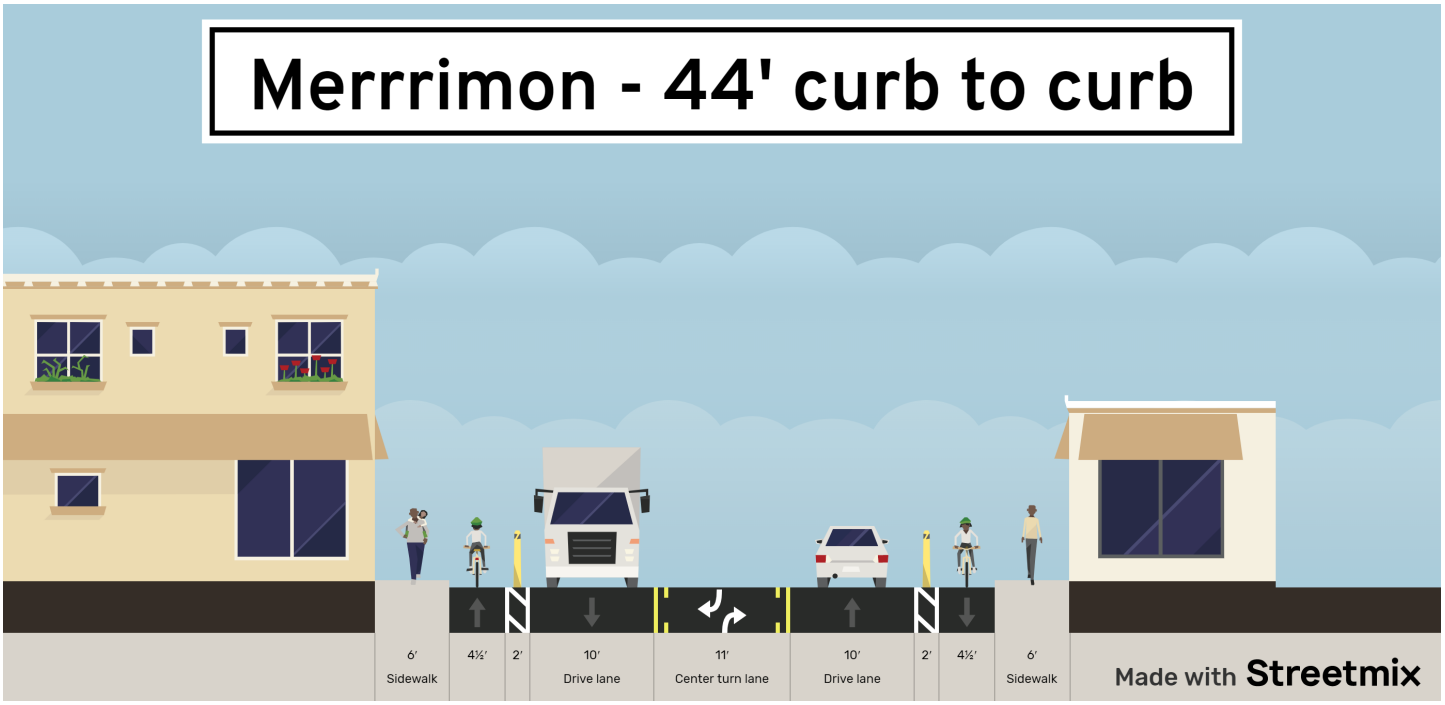
The options for hard line delineators vary in terms of cost and durability. The ones shown in the top image of Figure 21 have a harder plastic base and tubular markers that are on a pivot. The harder base provides more protection for bicyclists as they are harder to overtake than the ones in the bottom images. The tubular markers on a pivot allow them to bounce back more easily than the ones in the bottom image that are easily ripped out of the base when hit. Concrete curbing could be installed in these painted buffers to bolster the level of protection.

The frequency of driveway cuts along Merrimon could make these more challenging to implement, which is why the next section recommends the City and NCDOT work to consolidate driveways as part of the project or as properties redevelop.

Designers may have concerns over hard line delineators adjacent to 10 foot wide travel lanes and 5 foot or 4 foot bike lanes, which may be valid when there are such constraints. Therefore, it may be worth piloting them to see how well they perform. Concrete curbing is oftentimes used as a hard line delineator to protect motorists from other

Figure 21: Hard Line Delineators

Figure 22: Optional Cross Section with 40' from curb to curb



motorists in turn lane situations where traffic engineers want to control access. Ideally, engineers will desire more space in these situations, but there are examples of curbing being used immediately adjacent to motor vehicle lanes, as proposed for bike lane protection on Merrimon.

Once Merrimon's cross sections widen to 44 feet or more, there is greater opportunity for buffering and allocating more width to bike lanes. Even with a 44 foot cross section, as shown in Figure 22, the order of priority for allocation of additional width could first go to the center turn lane, followed by a 2-foot wide buffer between the bike lanes and travel lanes to create a de facto 11-foot outside travel lane. Additional space can be allocated to the bike lane, as well.

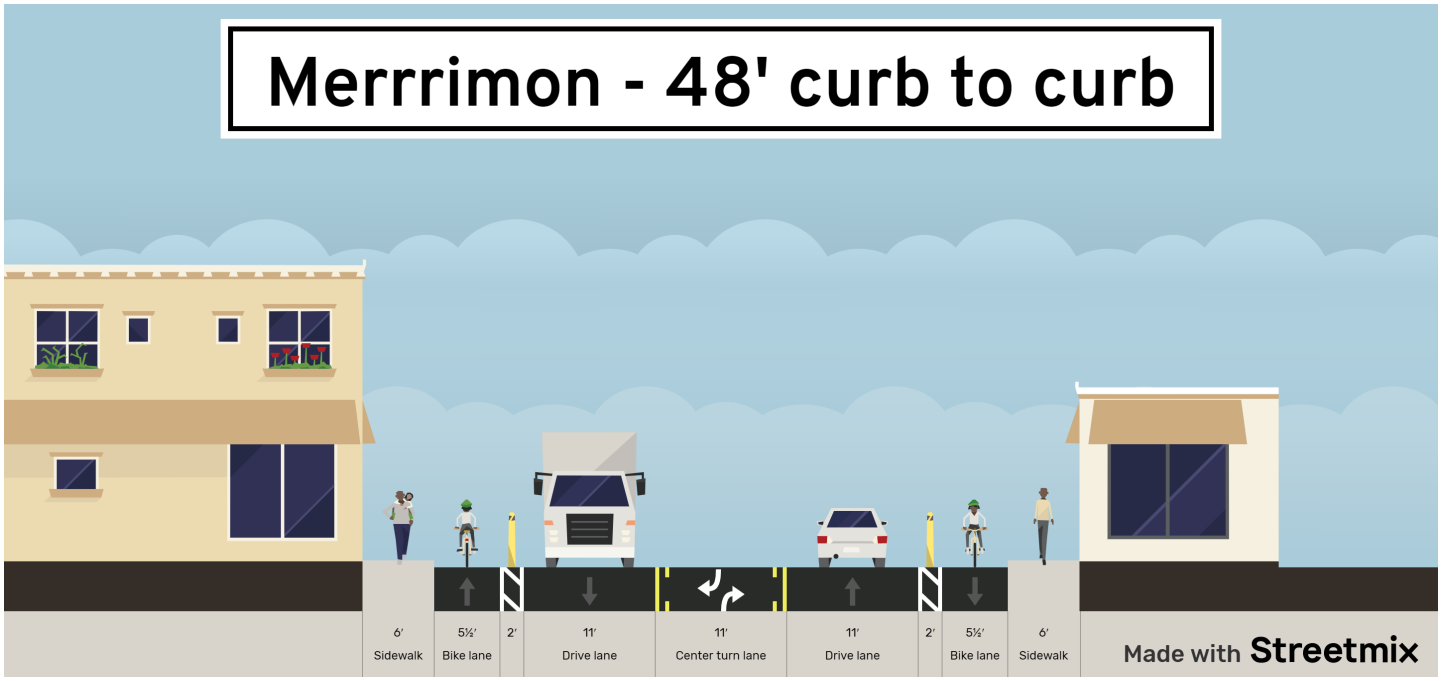
Once the cross section reaches 48 feet in width, there is the opportunity for 11 ft travel lanes, 2 foot wide buffers, and bike lanes of at least 5 feet, exclusive of gutter, as shown in Figure 23 (below).

Design Process, Road Safety Audit & The "Design Vehicle." A real fear is the design work taking place without input from people who bike, resulting in NCDOT prioritizing the allocation of space to 11 foot lanes versus carefully considering the dimensions to prioritize safe movement by bicyclists. The varying dimensions along Merrimon are also a concern in terms of how space is measured and allocated.

It is recommended that Asheville on Bikes advocate for a focused bike audit along Merrimon as design begins. In 2020, FHWA published a new version of its *Pedestrian and Bicyclist Road Safety Audit (RSA) Guide and Prompt List (29).* The guide outlines the process by which a safety audit can be performed to help inform a design process. Given there are no existing bike lanes on Merrimon, it is advisable that such a safety audit

Figure 24: The Bike Lane Design Vehicle

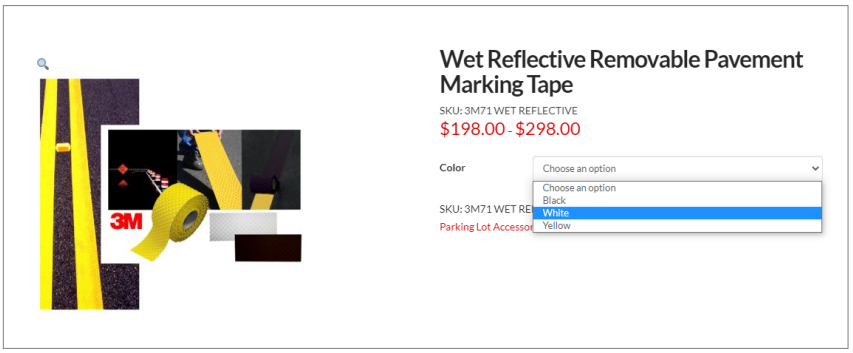
Figure 23: Optional Cross Section with 40' from curb to curb



include other routes in Asheville with bike lanes similar to what is proposed or possible along Merrimon. Charlotte Street is probably a good example given it was also subject to a road reconfiguration.

The images in Figure 24 at right show a typical bike with a trailer, which should be considered a design vehicle for an all users bike network. The varying dimensions of the preliminary bike lanes on the City's Craven Street project showed the challenges of keeping the design vehicle in the lanes. The result was the final application of bike lanes on Craven being wider than original applied.

Figure 26: Reflective Removable Pavement Marking Taps



One way to test these designs would be to have the City and NCDOT find a large parking lot and use pavement tape to mark off the various cross sections along Merrimon before they are fully designed. Removable pavement marking taps comes in white, yellow, and black colors and is oftentimes used for applications in construction zones.

Rubber parking wheel stops could be used to illustrate the location and effect of outside curbing. AOB could mobilize people with bike trailers, cargo bikes, and other emerging bicycle designs to show what it means to use those in the proposed cross sections. Trash bins and other possible curbside obstructions can be use to show how they fit within a space. If there are protected bike lanes or other vertical elements, they could also be applied in this setting and small equipment used to test how they could be swept and plowed.

Figure 27: Curbside Pushbuttons for Bicyclists

Other Design Considerations to Advocate For Along Merrimon

Curbside Pushbuttons and/or Loop Detectors for Bicyclists. For bike lanes along Merrimon, bicyclists should be detectable to the traffic signals. This can be accomplished by placing pushbuttons curbside facing the bike lanes, as shown in Figure 27. This allows the bicyclist to activate the signal without having to access the push buttons for pedestrians that are located on the sidewalks.

These may be more important to incorporate into the design of signalized intersections for streets that cross Merrimon, especially give some may not have motorists at all times of day to trip the existing sensors. These can also be applied if there are any RRFBs or PHBs (HAWKs) designed into the project for pedestrian crossings at unsignalized intersections or mid-block crossings.

Figure 28: Bike Lane Loop Detectors

Loop detectors placed under the bike lanes on Merrimon may be more advantageous than push buttons. They are an allowable use in MUTCD.

Flashing Yellow Arrows. NCDOT has increased its use of Flashing Yellow Arrows (FYAs) for left turns when there is a dedicated left turn lane. FYAs allow for motorists to turn left when there are gaps in traffic instead of having a dedicated left turn arrow (or in combination with them). The road reconfiguration will create left turn lanes at all intersections if they don't al-

ready exist. This can cause safety concerns for bicyclists moving in an approaching bike lane as they could be screen by approaching vehicles and be part of a crash when a driver shoots the gap. If curbside push buttons or loop detectors are used along Merrimon, the signal may be programmed to delay the FYA until there is time for a bicyclist to clear the intersection.

Pedestrian crossing Merrimon at Orange Street to reach a bus stop. The nearest signalized crossing of Merrimon with a pedestrian signal and crosswalk is at Chestnut. That signal is 650 feet away and requires a 1,300 foot out-of-direction trip to reach the other side. That out-of-direction trip could take 6 minutes of walking time, not counting delay in waiting for the WALK signal to cross Merrimon at Chestnut.

Non-Motorized Crossings & Spacing. The road reconfiguration of Merrimon will allow for greater consideration of RRFBs and PHBs at unsignalized intersections or at mid-block crossings. Large gaps in protected/signalized crossings mean both pedestrians and bicyclists are expected to go out of their way to reach a signal. AASHTO's Guide for the Planning, Design, and Operation of Pedestrian Facilities says "Pedestrians must be able to cross streets and highways at regular intervals. Unlike motor vehicles, pedestrians cannot be expected to go a quarter mile or more out of their way to take advantage of a controlled intersection" (30).

The FHWA-endorsed (31) *Designing Walkable Urban Thoroughfares* guide from ITE (2010) has more details for street settings like Merrimon, stating:

- "Pedestrian facilities should be spaced so block lengths in less dense areas (suburban or general urban) do not exceed 600 ft (preferably 200 to 400 ft) and relatively direct routes are available." (31)

This design guidance impacts whether or not pedestrians will walk out of their way to get to a signal or wait for a gap in traffic This may be especially true for transit stops. For many bicyclists, the thought of merging from the bike lane to the center turn lane is not a movement they desire to make. If crossings are not frequent enough, they may instead cross at the previous intersection and ride in a contraflow direction in the bike lane ("salmoning").

The image at right shows how people cross Merrimon at Orange Street to reach a bus stop. There is a notable gap in signalized crossings with crosswalks across Merrimon, which is why they cross here (a legal crossing, but not advised). Adding additional crossings will help the City realize the vision for Merrimon to be a premium transit route. Other notable gaps in safe crossings are listed below and should be considered for PHB or RRFB crossings in the design of the Merrimon reconfiguration:

- Hillside to Coleman: 2,000 foot gap between the signals. Annandale and Spears are marked crosswalks, but have no other treatment to get people safely across.
- Murdock to Edgewood: 1,500 foot gap between signals. Farrwood is a possible crossing location.

W.T. Weaver Pathway Crossing. The shared use pathway along Weaver ends at Merrimon. The curb ramps and crosswalk should be upgraded to match a shared use pathway width (10 feet preferred; 8' feet is acceptable due to constraints). This will allow bicyclists to transition from the pathway, cross Merrimon, and continue north in the proposed bike lanes. The receiving ramp on the east side should also be of a pathway width to accommodate bicyclists wishing to cross here to get to the pathway or access the southbound bike lanes.

Sidewalk Effective Width & Buffers. The sidewalk environment will remain constrained along Merrimon, especially in areas where there is limited potential for redevelopment. According to the Highway Capacity Manual, a sidewalk that is 5-feet in width but lacks of a buffer from the street constitutes a reduced effective width of 18 inches (Figure 29, next page). Utility poles in the sidewalk also reduce the effective width.

This means that every 5-foot wide sidewalk segment along Merrimon that lacks a buffer from the top of the curb has an effective width of only 3.5 feet. The result is it is difficult for two people to pass one another and feel safe in that space due to the proximity of moving vehicles. Additionally, shown in Figure 30, any type of vertical presence on the back side of the sidewalk constitutes an additional reduction of effective width by another 18 inches. Therefore, this sidewalk segment along Merrimon that is 6-feet in width has an effective width of only 3 feet.

The addition of bike lanes on Merrimon will help mitigate the feeling pedestrians have on narrow, 5-foot wide sidewalks as the motor vehicle traffic will be farther away from the curb. Any type of vertical elements in a bike lane buffer will help increase that feeling of comfort and safety, especially if a person in a wheelchair has to dwell curbside to allow another person to pass by them on the sidewalk. As Figure 31 shows, a bicyclist using the 5-foot wide sidewalks uses the entire effective width of the sidewalk and conflicts with wheelchair users can create unsafe conditions for both user types. The bike lanes will help reduce sidewalk riding, thus allowing more space for pedestrians on narrow sidewalks.

The City should continue to pursue buffered sidewalks as a condition of redevelopment along Merrimon to help buffer pedestrians from the street and maximize the effective width of sidewalks.

Non-compliant Driveways & Other Concrete Work. FHWA's Office of Safety "vehicles traveling at speeds over 25 mph can mount a curb at relatively flat impact angles," which means standard 6-inch curbs provide little deflection capability (32). Where there are locations along Merrimon where curbing is not at least 6 inches high due to road conditions (top right image on the next page),

Figure 29: Instructions for Calculating Effective Sidewalk Width; Highway Capacity Manual Exhibit 17-17

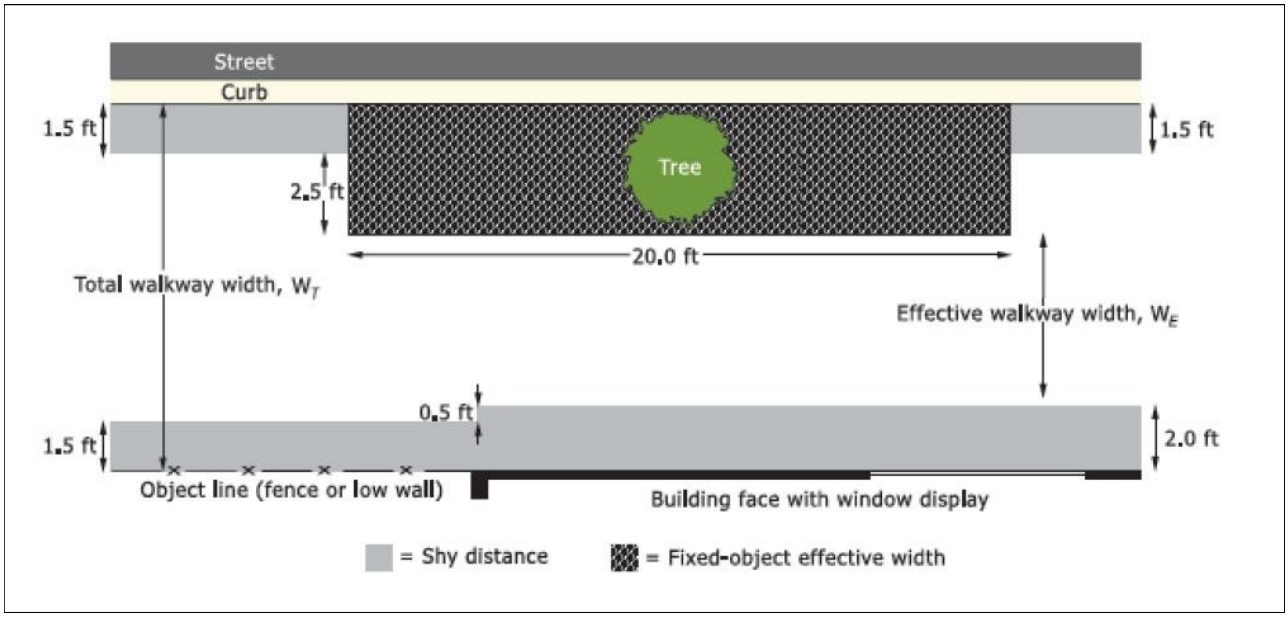


Figure 30: Effective Width of Merrimon Sidewalk

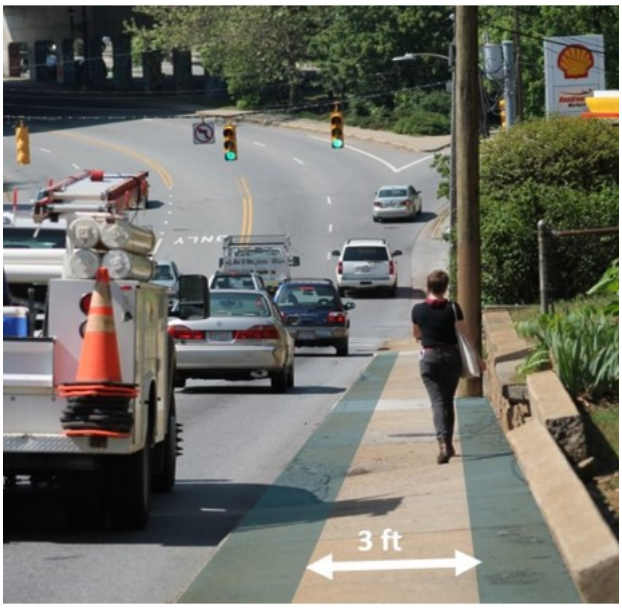


Figure 31: Bicyclist Using Sidewalk with 3.5 feet of Effective Width

then the rebuilding of those curbs should be part of the scope of the Merrimon project. This not only helps better define the street and provides for some deflection for vehicles at lower speeds, it also provides a clear edge for bicyclists instead of an almost flush transition to a sidewalk at random spots. At minimum, the project should include replacement of damage curb and gutter.

While resurfacing of Merrimon trips a federal requirement to upgrade curb ramps, there remain dozens of driveway cuts along Merrimon with cross slopes that exceed 2%. These were likely constructed before ADA requirements stipulated that a Pedestrian Access Route with a cross slope of no greater than 2% be provided on sidewalks that cross driveways. Simply upgrading curb ramps will not make the corridor accessible unless non-compliant driveways are rebuilt at the same time.

Curb Line Adjustment for Buffered/Protected Bike Lanes. Redevelopment of properties should be required to move curb lines to create a more desirable cross section on Merrimon (e.g. more similar to the 48 foot cross section options vs. the 40 foot cross sections). This will help maximize the space for bicyclists and provide a greater buffer area to place protected bike lane features between the bike lane and travel lanes.

This could be done in lieu of building a sidewalk buffer if the impacts of doing both are too great. Currently, City codes would likely require the sidewalk buffer without consideration of the need for a protected bike lane. This strategy should be discussed with the City to help guide future development along Merrimon and other similarly constrained corridors.

Remove Utility Poles. Utility poles obstruct the sidewalks in both new and old sections along Merrimon. These are also part of the clear zone that agencies like NCDOT desire to keep clear of such fixed obstructions. Protected bike lanes may provide for a solution for the clear zone issues, but utility poles will continue to impede sidewalk space.

A longer-term project would look at putting these utility poles underground to help promote a more aesthetic and safe corridor.

Smaller Service Vehicles. AOB can promote the City purchasing transit buses, firetrucks, waste management trucks, and snow plows that are narrower in width so the concerns over 10 foot travel lanes are reduced. This would also help with these vehicles moving through narrow residential streets that are common in Asheville.

Seasonal Maintenance. AOB should ensure the City and NCDOT have strategies to keep the bike lanes clear of snow and leaves, especially if there is some type of vertical protection. Bike lanes and sidewalks should not be used to store snow during winter storms. Smaller equipment can be purchased to sweep and plow protected bike lanes and the adjacent sidewalks.

Curbing almost flush with the street.

Driveway crossings have excessive cross slopes that can pitch wheelchair users into the street.

Utility poles remain obstructing relatively new sidewalks and should be moved or placed underground with the project or with redevelopment.

Identify desire lines and pave them to create functional pedestrian routes.

Other NC Road Reconfiguration Case Studies

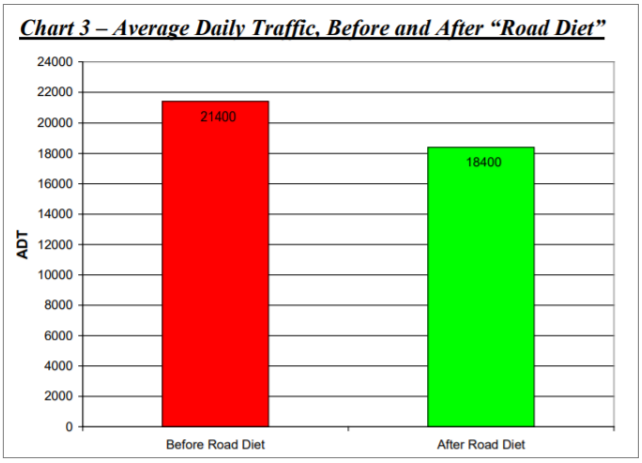
East Boulevard, Charlotte. This road reconfiguration in Charlotte has many similarities to Merrimon, most notably its design before the re-configuration (40-ft prevailing cross section) and its traffic volumes of 21,400 vehicles per day before the reconfiguration.

A paper published as part of ITE's 2007 Technical Conference highlighted the process and findings of the road reconfiguration. The before and after configurations were as follows:

- Before Condition (Four 10' Lanes) – East Boulevard from Dilworth Road West to Kings Drive
- After Condition - Two Lane Option (10'), With Center Turn Lane (11') and Bike Lanes (4.5') – East Boulevard from Dilworth Road West to Scott Avenue (existing four lane facility), East Boulevard from Scott Avenue to Kings Drive (two lanes with a center turn lane).

The traffic analysis found the conversion of East Boulevard from a four lane to a three lane roadway have a minimal impact on average travel speeds, primarily for eastbound traffic. Under before conditions, eastbound traffic averaged between 24 and 26 mph while westbound traffic averages slightly lower travel speeds in the 20 to 22 mph range. With the roadway conversion, eastbound travel speeds maintained a consistent 21 to 23 mph.

Average daily traffic did decrease from 21,400 vehicle per day to 18,400 vehicles per day when the project was implemented. According to Charlotte DOT, those traffic volumes have remained stable around 18,000 up through 2019. The paper states," "It should be noted that numerous jurisdictions have experienced the same phenomenon after implementing "road diets". Some motorists may have been scared away by the change, but could return gradually when they realize travel conditions were not as severely congested as they thought might occur. Additional data in subsequent years will support or refute this trend." (33) Peak hour volumes remained similar (34).



From a safety perspective, the project resulted in a lower operating speeds along the route and overall crashes decreased from 2.64 crashes per month to 1.67 crashes per month in the section converted from 4 lanes to 3 lanes. Pedestrian and bicyclists crashes did increase, which was acknowledged to be due to the increased activity for people using these modes when the reconfiguration was applied. (34)

An important component of this reconfiguration was the implementing of new traffic signal timing plans before construction began on the project. The white paper for ITE noted, "Signal timing modifications were implemented before construction started to get motorists used to the changes." This is something AOB should ask for from the City and NCDOT.

Hillsborough Street, Raleigh. A notable feature of this roadway reconfiguration project was that the traffic volumes on Hillsborough Street, while NC State was in session, were around 26,000 vehicles per day—well in excess of today's volumes on Merrimon and more than the 2045 modeled year volumes north of W.T. Weaver Boulevard. This helps dispel the myth that there is a threshold at which a conversion from 4 lanes to 3 lanes should not be considered.

It was estimated that 30% of that 26,000 vehicles per day were "through" trips along the corridor, which meant there was a high potential for them to choose other routes to get to their destinations once the reconfiguration was implemented. Today, NCDOT traffic volume data shows vehicles per day range from 17,000 to 18,500.

Even though Hillsborough had a posted speed limit of 35 mph (as Merrimon does), the average travel speeds in the early 2000s studies showed the average speed was 22.4 mph. (35)

The results were:

- Vehicle crashes decreased by 23%
- New private investments increased from $150 million to $200 million along the corridor
- Miles of sidewalk have nearly doubled. (36)

The 2012 crash data analysis that indicated a 23 percent overall reduction in crashes after construction found each subsection of the study area saw a reduction in crashes, except for the roundabout at Pullen Road and Hillsborough Street. NCDOT engineers responded to the problem by modifying the roundabout from a double-lane to a single-lane facility in July 2012, bringing crash rates back down at this location. (37)

"The improvements along Hillsborough Street have changed interactions between motorists and pedestrians, slowing down motorists and encouraging higher frequencies of pedestrian traffic." - NCDOT (37)

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