

Issue Papers Prepared by Toole Design Group

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1. Bikeway Classification

Classification of bikeway types is an important step to help planners comprehend how parts of the bike network function and work together. The need for a new bikeway classification system in Montgomery County springs from the introduction of new facility types in the Bicycle Master Plan update, as well as a need to better link policy objectives to the network classification system. Creation of a network classification system that has real policy impacts in the decision-making process can help move the bike plan from lines on a map to a truly useful tool.

Classification also provides planners and the public an understanding of the level of bicycle accommodation on streets in the network and give guidance about prioritization and implementation. This paper refers to two types of bikeway classification:

- Facility classification: groups bikeways by the type of facility; for example, separated bike lanes, bike lanes, shared roadways and trails, and
- Network classification: provides a framework for understanding a given bikeway's function or importance in the network, typically by designating a primary and secondary network.

The approach that Montgomery County takes to each of these types of bikeway classification can play an important role in the County's efforts to create a world-class bicycle plan and to be an exemplar of suburban bicycling in the U.S. Using network classification as a means of indicating critical routes will facilitate creation of a connected low-stress network. This is not to say that every primary bikeway would be separated bike lanes on a major street, but every primary bikeway *would* play a key role in providing a low-stress connection.¹ A higher network classification would indicate a route's fundamental importance to the bike network and give County staff guidance at the time of facility design decisions.

This paper provides an overview of Montgomery County's current classification schemes for bikeways. This is followed by a summary of classification practices from a number of local and national cities. Finally, recommendations are presented for how Montgomery County should move forward with classification in its Bicycle Master Plan update. It should be noted that this paper focuses on bikeway classification for the purposes of master-planning and implementation, not for creating bicycling maps or wayfinding.

Current Montgomery County Bikeway Classification

Montgomery County's existing classification scheme was developed for the 2005 Countywide Functional Bikeways Master Plan and includes both facility classification and network classification. Facilities are classed by type and include:

- Shared use path
- Bike lane

¹ It should be noted that network classification and the importance of a given route to the network is only one component of a prioritization scheme. Overall prioritization of the bike network for phased implementation is not addressed in this paper.

- Signed shared roadway
- Dual bikeway²
- Cycle tracks

Facility types were not grouped by bicyclist level of comfort or degree of separation provided from automobile traffic.

The County uses Countywide and Local routes for network classification. Countywide routes comprise about two-thirds of the network and were the focus of the 2005 Plan. These routes generally are located on arterial streets and provide longer distance connections, linking major destinations throughout the County. Local routes are those that feed into the county route system, typically from smaller neighborhood origins and destinations. The countywide/local designation has no inherent relationship to the prioritization or implementation of facilities.

Necessity of a New Classification Scheme

The Bicycle Master Plan update could include as many as twelve facility classifications, thus grouping facility types may benefit the County so as not to create a greater level of complexity than necessary.

The current network classifications of Local and Countywide route types appear to serve little or no function and likely adds unnecessary complexity to the network definition. Since Countywide bikeways comprise about two-thirds of all master-planned bikeways, this designation does not indicate those bikeways that are the most important and which therefore should be prioritized in discussions related to limited space and trade-offs between various travel modes, or designed to a higher standard (e.g., separated bike lanes that are wider than typical conditions) in anticipation of large bicycle volumes. Designations have not been related to prioritization of implementation. Creation of a network classification system that has real policy impacts in the decision-making process can help move the bike plan from lines on a map to a truly useful tool.

Example Classification Schemes

This section reviews bikeway classification schemes in a number of local jurisdictions and exemplary bicycle communities in other parts of the country. Few counties around the country create bike plans to the level of detail and implementation-ready recommendations that Montgomery County does. For this reason, Arlington County and Hennepin County are the only two examples of county-wide plans included here. While the rest of the plans are from cities, they are worth reviewing as exemplar bicycling communities, some of which have suburban-type roadways, such as Portland, Minneapolis and Seattle.

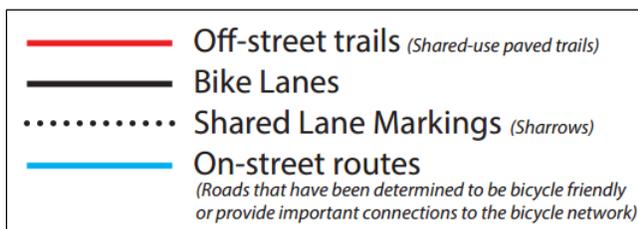
² Montgomery County developed the dual bikeway facility type in the 2005 Countywide Bikeways Functional Master Plan to recognize differing levels of ability and comfort among bicyclists and to recognize the two functions (transportation and recreation) that a bike network serves. Dual bikeways include both an on-street bikeway and an off-road shared use path on the same roadway.

Arlington, Virginia

Arlington County uses a facility classification system and does not have a network classification for its bikeways. Arlington’s bikeway classification was last updated in the 2008 Master Transportation Plan,³ though the County is considering updates as they move forward with a countywide Level of Traffic Stress analysis that will lead to identification of new network recommendations. Currently, there are four facility type categories:

- Off-street trails
- Bike lanes
- Sharrows
- Bike routes

To date, the two buffered bike lane and separated bike lane facilities in Arlington have not been differentiated from standard bike lanes and remain in the “Bike lane” category. The County may update this classification as more buffered and separated facilities are implemented. Two facility types that Montgomery County will use in the plan update are not included in Arlington’s scheme: advisory bike lanes and bike boulevards. Arlington is considering implementation of these facility types as well but has not yet decided how to classify them.



Legend from Arlington County's 2015 public bike map update

Additionally, “bike routes” are “roads that have been determined to be bicycle-friendly or [emphasis added] provide important connections to the bicycle network.” These streets have not been improved with signage or markings, and they have not necessarily been vetted for comfort and suitability of crossings for bicyclists. Some streets may not be very bicycle-friendly, but they are included in the route network because they provide an important or direct connection. This route network will also be revisited as the LTS analysis is completed to better identify bicycle-friendly streets and focus on intersection improvements.

Washington, DC

DC’s bikeway classification was last updated as part of the MoveDC⁴ plan completed in 2014. The Plan is not explicit in its classification of facility types as it refers to one set of facility types on maps and another when describing the facility types available to planners. Maps include the following:

- Trail
- Cycle track
- Bike lane, including contraflow and climbing lanes

³ <http://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2014/02/DES-MTP-Bicycle-Element.pdf>

⁴ <http://www.wemovedc.org/>

The plan mentions the following commonly used facility types:

- Shared-use paths
- Cycle track
- Bike lane, including climbing and contraflow lanes
- Sharrows
- Signed shared routes and Neighborhood Bikeways
- Shared roadway (all other roads minus freeways)

However, the planned network does not include any facility types other than the three included on the map. The District has undertaken a separate wayfinding effort to identify signed routes that consist of streets with bike facilities and those local streets that are bicycle-friendly. The Neighborhood Bikeway identification and signage program is also separate from the master planning effort and the wayfinding program.



Legend from MoveDC Bicycle Element map

DC does not have network classification for its bikeways. MoveDC does articulate modal priorities for all DC streets, including the identification of some “bicycle priority” streets. However, these priorities have not yet had any bearing on trade-offs made in the course of design for a multimodal street.

Minneapolis, Minnesota

The City of Minneapolis updated its facility classification in 2015 as part of a bike plan update⁵ aimed at incorporating protected facilities into their toolbox. This update did not define a new bike network for the city, rather focused only on short-term recommendations for the locations of new protected bike lanes. The update includes the following facility classes:

- Protected bikeways
 - Off-street trail
 - Pedestrian/bicycle bridge
 - Sidepath
 - Protected bike lane
- Bike lanes
 - Buffered bike lane
 - Bike lane
 - Contraflow bike lane
 - Advisory bike lane
 - Shoulder accommodation
- Bike boulevards
- Shared lanes

⁵ <http://www.minneapolismn.gov/www/groups/public/@publicworks/documents/images/wcms1p-144745.pdf>

- Sharrows
- Signed bike route
- Shared bus/bike lane

These classes are generally based upon the bicyclist’s experience on the street and the level of interaction he will have with automobiles. Bike boulevards are classed separately from other types of shared lanes because of their lower volumes and speeds. Signed routes are assumed to be comfortable enough for bicyclists without additional pavement markings.

Minneapolis’ 2011 bike network plan⁶ is modeled after roadway classification and states that the classification purpose is to help prioritize projects and make better use of limited funds. The classification is as follows:

- Arterial Bikeway: Routes of regional significance that attract the highest number of bicyclists and are intended to form a “spider web” pattern centered on downtown Minneapolis
 - Principal arterials spaced at two-mile intervals designed for grade separation and faster speed
 - Minor arterials spaced at one-mile intervals
 - May be situations where two arterial bikeways are located parallel to one another in close proximity because their differing facility types serve different user groups
- Collector Bikeway: Feed into arterial bikeways; spaced at half-mile intervals to capture bicyclists from every part of the city
- Neighborhood Bikeway: Feed into collector bikeways; found in every neighborhood and not eligible for regional funding

While the intent of this scheme is to prioritize bikeways, it has not been used this way in practice. Minneapolis maintains a robust bicycle counting program that City staff found to be a better indication of the importance of any given bikeway project than network classification. Connections to locations with higher existing counts or locations with high counts and deficient facilities have been prioritized.

Hennepin County, Minnesota

Hennepin County completed a bike plan⁷ in 2015 that is separate from the Minneapolis one detailed above. The plan classed bicycle facilities in the following groups:

- Off-street
 - Multi-use trail
 - Cycle track
 - Protected bike lane
- On-street

⁶

http://www.minneapolismn.gov/www/groups/public/@publicworks/documents/webcontent/convert_275983.pdf

⁷ <http://www.hennepin.us/~media/hennepinus/residents/transportation/bike/bike-plan/bicycle-transportation-plan.pdf>

- Cycle track
- Protected bike lane
- Buffered bike lane
- Bike lane
- Shoulder
- Bicycle boulevard

These broad classes were chosen to avoid being overly prescriptive on facility type throughout the county. Hennepin County recognized that it would not be the implementing agency for many of the recommended facilities and wanted to leave flexibility for other jurisdictions. Additionally, the level of effort needed for further facility specificity throughout the network was not possible in the scope of this planning effort.

Network classification consists of a plan recommendation to designate an “enhanced bicycle network.” This recommendation emerged from the public engagement process where it was clear that bicyclists and potential bicyclists sought a greater amount of separation from automobile traffic. This classification touched on both facility type and network function with the recommended characteristics:

- Facility type is off-street trail, cycle track or protected bike lane
- Part of Minneapolis’ protected bike lane network
- Within a priority regional bikeway corridor as identified in Metropolitan Council Regional Bicycle System Study
- Part of a route that spans major barriers (e.g., river, railroad, highway)
- Connects major activity centers

This framework has not yet been used for implementation in the county, nor has the County used these criteria to identify its enhanced bicycle network.

Boston, Massachusetts

The Boston Bike Network Plan⁸, updated in 2013, identifies five classes of bikeway facilities:

- Off-road path
 - Shared use path
- Protected Bike Lane
 - Cycle track
- Exclusive Lanes
 - Buffered bike lane
 - Bike lane
 - Contraflow bike lane
 - Climbing lane

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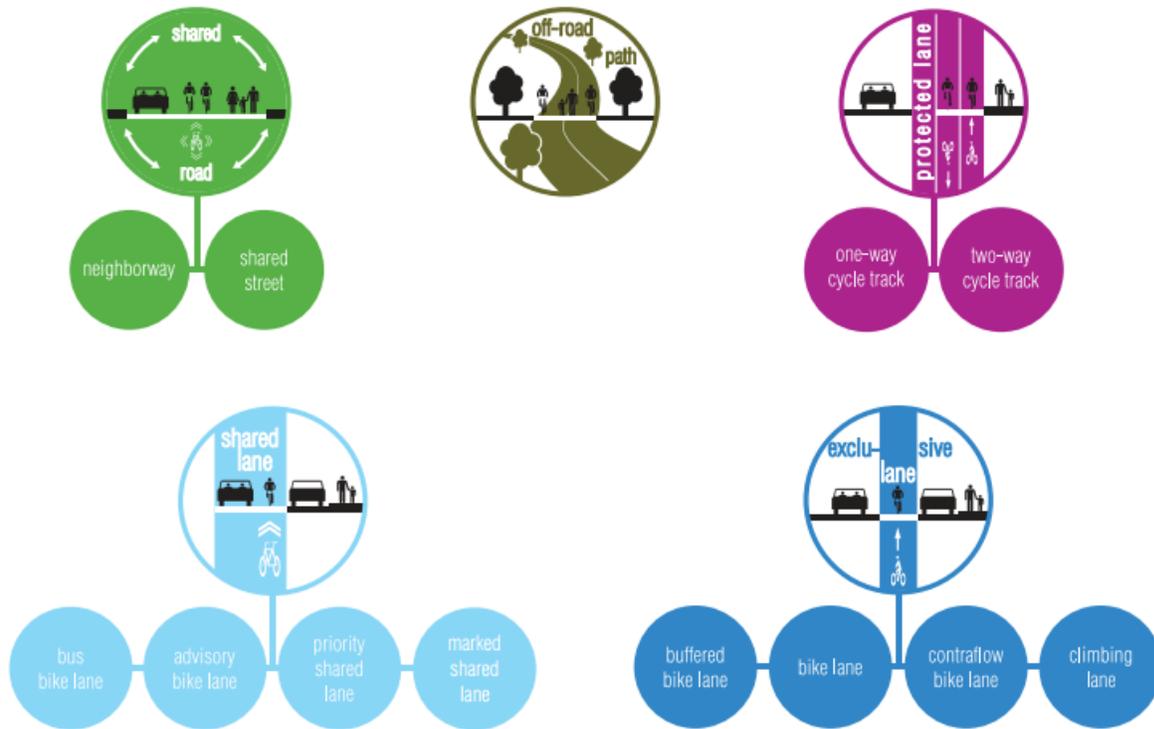
http://www.cityofboston.gov/images_documents/Boston%20Bike%20Network%20Plan%2C%20Fall%202013_FINAL_tcm3-40525.pdf

- Shared lanes
 - Advisory bike lanes
 - Priority shared lane
 - Shared lane: denoted with sharrows and signage; constrained corridors with speed limit 35 mph or less
 - Bus-bike lane
- Shared roads
 - Shared street (flush)
 - Neighborway: added traffic calming, prioritizes bicyclists and pedestrians, equivalent to a bicycle boulevard
 - Recommended local route: unimproved route that provides connectivity, generally lower volume and/or speed than a sharrow street

These classes have enabled the City to work with a wide variety of facility types that suit the wide range of street types but also retain a manageable vocabulary of bikeways. Facilities are classed, generally, according to the bicyclist's experience on the street. For instance, an exclusive lane is roadway space specifically dedicated for bicyclists but not immune from periodic obstructions such as double-parked

cars. By classifying buffered bike lanes this way, perhaps the City misses expressing some of the advantage that a wider facility provides, but it also is recognizing the reality of the daily experience.

FIVE TYPES OF BICYCLE FACILITIES



Facility classification graphic from Boston Bike Network Plan

Boston’s plan does further classify the network into primary and secondary routes with the following definitions:

- “Primary routes connect neighborhood centers, regional multi-use paths, transit hubs, major employment centers, and institutional destinations.”
 - Provide long distance routes
 - Carry the highest volumes
 - Have as much separation from traffic as possible
 - Include all major bridges
- “Secondary routes stretch into neighborhoods and provide access to local businesses and neighborhood destinations.”
 - Connect schools, neighborhood stores, parks, transit hubs and the primary network routes
 - Have varying levels of bicyclist volumes and separation from traffic

These definitions are helpful in conceptualizing the network and prioritizing facilities at a high level, but in practice the designations have not had a clear effect on implementation. Closing gaps in the existing facilities along primary routes was prioritized, but the five-year action plan consists of streets and trails that are both primary and secondary routes. Implementation has been based more on opportunities and in response to problems rather than guided by a goal of improving the primary routes first.

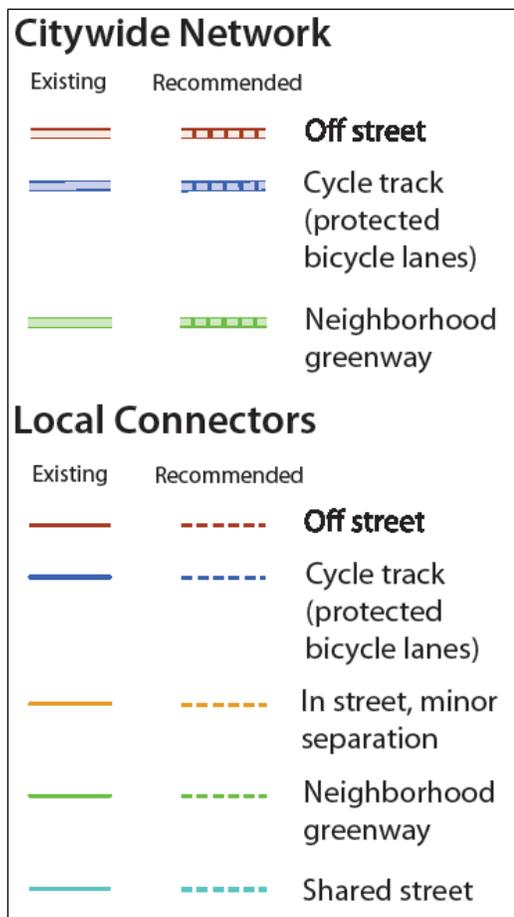
Seattle, Washington

The 2014 Seattle Bike Plan⁹ identified five facility types for its network, which only group bike lane types together:

- Off-street
- Cycle track
- Neighborhood greenway
- In street, minor separation (buffered bike lane, bike lane, climbing lane)
- Shared street (sharrow)

Each facility type is designated for use on streets with certain speed, traffic and functional classification criteria. Though not every recommendation conforms to these usage standards, they provided a framework for network development that leads to a system with greater separation between bicyclists and automobiles on higher-speed, higher-volume streets.

Seattle’s network classification is the only one examined for this study that links network classification to available facility types by calling for exclusively low-stress facilities to be used in the Citywide network so that Citywide routes are accessible to “all ages and abilities.” In practice, this means that some facility types, such as bike lanes, that may result in a low-stress riding environment on low-volume, low-speed roads are not included in the Citywide network. The classifications are defined as below:



Legend from network map in Seattle Bike Plan

- Citywide Network:
 - Provide short distance connections to neighborhood destinations, as well as connections to destination clusters across neighborhoods and throughout the city
 - Allow people of all ages and abilities to access all major destinations on this network
 - Composed of cycle tracks, neighborhood greenways and off-street multi-use trails

⁹ <http://www.seattle.gov/transportation/bikemaster.htm>

- Local Connectors:
 - Provide access to and parallel the Citywide Network and serve destinations
 - Lower level of separation with bike lanes, buffered bike lanes and shared roadways also in facility toolkit
 - May provide a more direct route, but may include facility types and streets that are not appropriate for all ages and abilities

The Citywide and Local classifications have little bearing on facility implementation other than to prescribe a set of facility options. While the plan identifies high-demand segments of the Citywide Network as a near-term priority, further project prioritization does not rely on a bikeway's classification as Citywide or Local.

Portland, Oregon

Portland's 2010 bicycle plan¹⁰ classes facility types by level of separation. These classes are:

- Trails
- Separated in-road bikeway
 - Cycle track
 - Buffered bike lane
 - Bike lane
- Shared roadway bikeway
 - Bicycle boulevard
 - Advisory bike lane
 - Enhanced shared roadway

The enhanced shared roadway facility type is used in locations where bicyclists are not given priority, but signage and markings are used to increase driver awareness and traffic calming or signalization may ease bicyclist travel. These facilities may be later upgraded as money and willingness to adjust the allocation of roadway space to various modes allow.

¹⁰ <https://www.portlandoregon.gov/transportation/44597>

<p>Trails</p> <p>Existing or funded trail</p> <p>Future trail</p> <p>Separated in-roadway bikeways (bike lanes, buffered bike lanes, cycle tracks)</p> <p>Existing or funded bike lane or separated in-roadway</p> <p>Future separated in-roadway</p> <p>Future separated in-roadway or enhanced shared roadway</p> <p>Future separated in-roadway or advisory bike lane</p> <p>Future separated in-roadway, advisory bike lane, or enhanced shared roadway</p>	<p>Bicycle boulevards / advisory bike lanes</p> <p>Existing or funded bicycle boulevard</p> <p>Future bicycle boulevard</p> <p>Future advisory bike lane (suggested)</p> <p>Future enhanced shared roadway or advisory bike lane</p> <p>Future bicycle boulevard or advisory bike lane</p> <p>Enhanced shared roadways</p> <p>Funded enhanced shared roadway</p> <p>Future enhanced shared roadway</p> <p>Future bicycle boulevard or enhanced shared roadway</p>
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Legend from Recommended Bikeway Network map in Portland Bicycle Plan

Portland includes a robust, policy-level classification of bikeways by functional class. These classes include:

- Major City Bikeway
- City Bikeway
- Local Service Bikeway

This policy-level classification exists for other modes in the city, so adoption of this system for the bicycle mode is recognized as bringing consistency and parity to the modes. Functionally, Major City Bikeways are the most important routes in the city—those that carry the highest volume of bicyclists, connect to major commercial areas or bridges, a long corridor that serves many neighborhoods, or serve to collect traffic from other routes that feed into them. City Bikeways provide direct and convenient access but do not fit the characteristics of a Major City Bikeway. All modes in the city have a “local service” class that simply includes all other unidentified streets.

The Major City Bikeway designation allows City staff to advocate strongly for the highest order bike facility on those streets. Where trade-offs are needed to accommodate space for these facilities, planners in the bicycle program are in a better position to press their case. The policy that defines each of these types specifically states that travel lanes and/or on-street parking may be removed to accommodate bicycle facility space on streets under both bikeway classes. The designation as a Major City Bikeway does not dictate the facility type recommended for that route; any facility type may be in place on that bikeway as long as it provides an appropriate level of accommodation suited to the street characteristics.

Summary

Municipalities vary in their facility classification schemes. Grouping of facility types was most often based on the level of separation a facility provides the bicyclist from automobile traffic. Boston’s grouping is slightly more granular in that it differentiates shared roadway conditions between those

with higher and lower automobile volumes, and Minneapolis does this to some extent, too, by separating bicycle boulevards from other shared roadway facility types.

While approximately half of the examined jurisdictions further differentiate their networks by functional class in some manner, only Seattle and Portland's network classification schemes have direct implementation impacts by prescribing facility types and a level of importance in trade-off discussions, respectively. In other cities, a project's network classification may be one factor in the project prioritization process, but network classification does not imply priority in terms of implementation timeline.

Recommendations for Montgomery County

Given the above review of recent bicycle planning efforts around the country and understanding of the Montgomery County context, the following recommendations are made for bikeway classification. These recommendations will help the County achieve its ultimate goal of implementing an extensive, low-stress network. The most important characteristics of this network will be its connectivity and density.

Network Classification

The County should refine its County/Local network classification framework in favor of a policy-level network classification in the style of Portland, OR. An adopted system of Major County Bikeways (MCB) and County Bikeways (CB) would provide a framework for discussions about bikeway design in areas of constrained rights-of-way. All other roadways where bicycle travel is permitted could be designated as Local Serving Bikeways (LSB) if full coverage of county roadways is desired. Similar to Portland, a **MCB would be a bikeway of the highest importance in the county, meaning that the bicycle accommodation should be prioritized in discussions related to limited space and trade-offs between various travel modes. Similarly, MCBs should be designed to a higher standard (e.g., separated bike lanes that are wider than typical conditions) in anticipation of large bicycle volumes.**

Unlike Seattle's network classification, it is not recommended that the County use the MCB/CB structure to require a specific facility type for these bikeways. Not all MCBs would be high-investment facilities such as separated bike lanes on large arterial streets. Some MCBs will be important connections that can be made via low-volume, low-speed streets with facilities such as advisory bike lanes.

The definition of criteria for MCBs should occur during the network-development process. It is impossible to know before the entire network is developed what criteria will best capture those streets that serve a critical network function. A preliminary list is given below, but this list should be viewed as draft and subject to change during the plan development process. One or more of the following could be required for MCB designation:

- Access to major destinations: employment centers, key commercial zones/corridors, transit facilities
- Access to multiple neighborhoods
- Connections to major trails

Network classification should not be viewed as a prioritization scheme, however. The class of a bikeway project will need to be combined with a number of other factors determined by the County in order to create a prioritized project list for the bike plan.

Facility Classification

The County should adopt a grouped classification of facility types in order to make the network easier to comprehend and to better reflect the County's interest in Level of Traffic Stress. Some of the 12 facility types noted below share functional characteristics, and it is unnecessary to differentiate them on a plan

map. The simplified map will provide an adequate level of understanding while not being overly detailed. By defining facility groups based on level of separation from traffic provided, planners with knowledge of the street network will be able to understand how comfortable a given facility type recommendation will be on that street.¹¹

It should be noted, however, that the same facility type has different stress levels in different applications. For instance, a buffered bike lane can be a low-stress facility where speed limit and number of lanes are low, but the extra width between the rider and automobiles cannot overcome the stress of higher speed traffic or a wide roadway.

The County should classify bikeway facilities as outlined below: *[Note that signed shared roadways and dual bikeways are not included in this scheme as their continued use by the County in network planning will be addressed in the Facility Types paper at a later date. This section will be updated as needed, or not, with those facility types.]*

- Shared use paths
 - Trail (separate right-of-way)
 - Sidepath (within a street right-of-way)
- Separated bike lanes
- Bike lanes
 - Buffered bike lanes
 - Bike lanes
 - Climbing lanes
 - Contraflow lanes
 - Advisory bike lanes
 - Shoulder accommodation *[Discussion of whether this should be a “facility type” will come up in the signed shared roadways paper, but it is left in for now.]*
- Bicycle boulevards^{12,13}
- Shared roadways
 - Priority shared lane markings
 - Shared lane markings

¹¹ The full level of facility specificity should be maintained in the project/bikeway table portion of the plan so this information is available to readers.

¹² Bicycle boulevards are separated from other shared roadway facilities because they provide a different level of comfort for bicyclists. A bicycle boulevard design will include traffic calming, intersection improvements to ease crossing major streets, and may include some traffic diversion to lower volumes. These elements are not included in the other shared roadway facilities.

¹³ Montgomery County may wish to begin discussions regarding the nomenclature used for these facilities. While “bicycle boulevard” is used by some communities, with Berkeley, CA being a notable pioneering user, many jurisdictions are beginning to use terms that reference the benefit of these streets to a broader audience. “Neighborway”, “Neighborhood Greenway”, “Neighborhood Bikeway” and “Neighborhood Slow Street” have all been used for this facility type and imply a benefit to pedestrians and residents as well as bicyclists.

2. Advisory Bike Lanes

Residential streets with higher traffic volumes and speeds can make bicycling uncomfortable for some people. Where space is available, one response could be to add conventional bike lanes to reduce traffic stress.



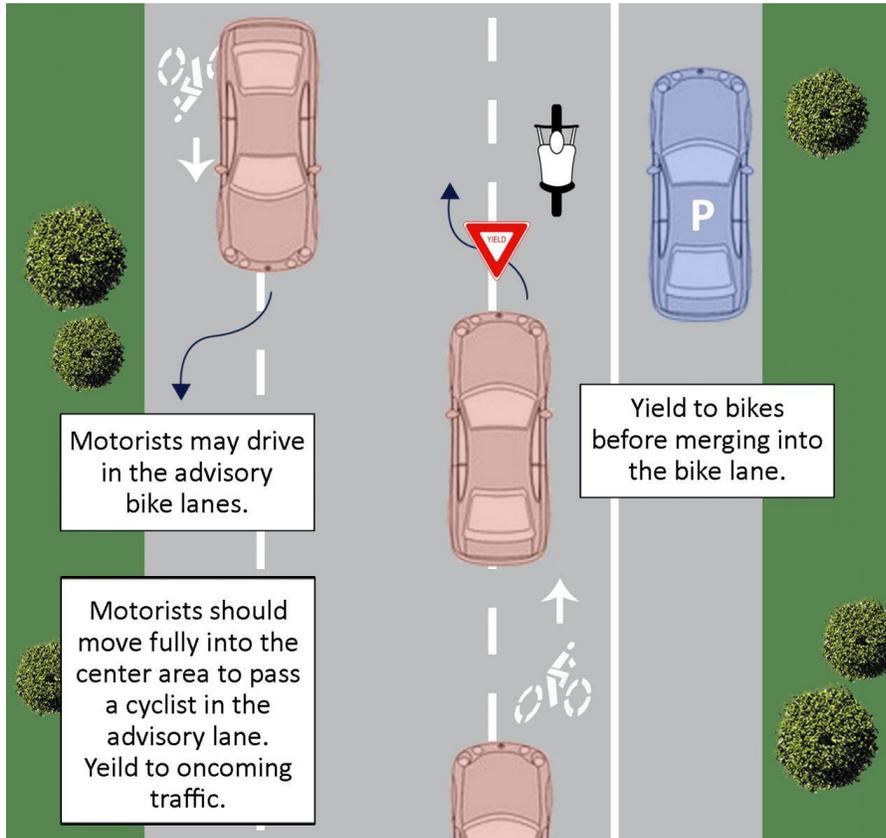
Un-laned, two-way “yield” streets, such as Indian Spring Drive, are common in residential neighborhoods in Montgomery County

However, many residential two-way roads are too narrow to provide space for two standard width bicycle lanes and two standard width automobile travel lanes. Advisory bike lanes (ABLs) are a way to reduce the stress of bicycling on lower volume and lower speed streets where there is insufficient space for two travel lanes and two bike lanes.

For lower volume, lower speed streets, ABLs are an alternative to a shared lane marking treatment which separates bicyclists from automobile traffic. These streets are marked to provide two separate standard width bicycle lanes, on either side of a single shared (un-laned, two-way “yield” street) motorist travel space, essentially creating a three-lane street cross section. Roadway centerlines are not present in this condition.

The design of streets where ABLs are implemented does not provide sufficient space for motorists to pass each other within the vehicular travel lane and therefore implicitly provides bicyclist priority along a street with ABLs. Motorists are encouraged to drive in the center of the roadway by the ABL pavement markings along the sides of the street. Unlike a standard bike lane where motorists are discouraged from entering the bike lane with a solid lane line, the ABL is continuously dashed to allow motorists to temporarily enter the bike lane to provide oncoming traffic sufficient space to safely pass. This behavior is similar to passing behavior on narrow, un-laned, two-way “yield” streets where traffic lanes are not designated with striping and so motorists must pull to the side (into parking gaps or driveways) to let

oncoming vehicular traffic pass. Yielding in this fashion is necessary because ABLs reduce the automobile travel space to a width of 12 to 18 feet, less than the typical 20 to 26 feet for two travel lanes.



Yielding patterns in advisory bike lanes. Note that drivers more typically position vehicles in the center lane than in the bike lane except in cases of passing. (City of Minneapolis Graphic)

Some locations where sight lines are not clear, such as hills or curves, may present issues for the implementation of advisory bike lanes. In these cases, some additional modifications may be used to mitigate potential conflicts. For instance, a spot roadway widening or removal of a parking lane at a curve may enable widening of the vehicle travel lane to a width where two automobiles may pass comfortably. Speed humps could also be used at the crest of a hill to further calm traffic speeds and give drivers ample time to react and yield to a vehicle approaching in the opposite direction.

Given that advisory bike lanes remain a relatively new facility type in the U.S., most communities implementing them have also created education campaigns about their use, especially regarding yielding expectations. Drivers and bicyclists can be educated through mailings, door hangers (targeted at nearby residents), on-site flyer handouts and other means. The striped and marked facility is not typically accompanied by signage indicating yield patterns, but this is not precluded by any current guidance. A sign example from Hanover, NH is included in the domestic examples below.

International Criteria

Advisory bike lanes have been used in numerous European countries in both urban and rural contexts. The guidance below is from the Dutch CROW traffic design manual. This manual specifies use of advisory bike lanes, or “suggestion lanes” as they are referred to in the Netherlands, in a limited context. The key criteria identified in the CROW manual for application of ABLs are speed limit (19 mph) and traffic volume (up to 5,000 average daily traffic)¹⁴. Centerlines are not striped on these streets.

Lane configuration	Daily traffic (veh/day)	Street type and speed limit			
		Urban local street	Urban through street	Rural local road	Fast traffic road
		30 km/h (19 mph)	50 km/h (31 mph)	60 km/h (37 mph)	70+ km/h (44+ mph)
Two-way traffic with no centerline	≤2500	Default layout is advisory bike lanes (shown as “mixed.”)	Bike lane or cycletrack	Advisory bike lane bike lane or cycle track	Cycle track or low-speed service road
	2000–3000				
	3000–5000				
	>4000	Bike lane or cycle track	Bike lane or cycle track ^c		
Two lanes (1+1)	any	Bike lane or cycle track	Bike lane or cycle track ^c		
Four lanes (2 + 2) or more	any	(Does not exist)	Cycle track or low-speed service road		

CROW Dutch traffic manual chart for facility application indicates use of advisory lanes for low-speed, low-volume streets.

¹⁴ CROW, *Design Manual for Bicycle Traffic*, p 108.



Advisory bike lanes on a local street in Amsterdam

The City of London’s design guidance specifies that advisory bike lanes be used on streets with low speed limits. For locations with on-street parking, the guidance recommends a minimum bicycle lane width of 6.5 feet. It also recommends the use of a striped buffer between the lane and the parking lane and the placement of bicycle symbols at the outer edge of the advisory bike lane.¹⁵

Domestic Examples and Criteria

Advisory bike lanes are a relatively new facility type to the United States, but they have been installed in a number of different contexts around the country. ABLs are not included in the current Manual of Uniform Traffic Control Devices and require experimental approval from the Federal Highway Administration (FHWA) for application. FHWA calls ABLs “dashed bike lanes” and requires two design elements for the request to experiment: bike lane signs and bike lane pavement markings. Additional design elements are recommended or suggested and are available on FHWA’s website.¹⁶ Approval has been granted to numerous communities around the country in communities as varied as Hanover, NH (pop. 11, 000) and Minneapolis, MN (pop. 400,000).

Minneapolis, MN

The City of Minneapolis was the first US city to install advisory bike lanes in 2011. This application was on a downtown street that connects to a number of other bike facilities and is the only lower-volume through street in this part of the city. East 14th Street has parking on both sides, and the width varies from 40’ to 44’. Parking is striped at 7’ and the ABLs at 6’. This results in an un-laned automobile travel space of 14’ to 18’. Since their installation, there has been no increase in head-on automobile crashes and overall speeds have dropped creating a safer environment for drivers, bicyclists and pedestrians.

¹⁵ <http://content.tfl.gov.uk/lcds-chapter4-cyclelanesandtracks.pdf>

¹⁶ https://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/mutcd/dashed_bike_lanes.cfm

Currently there are three locations in Minneapolis with ABLs. The other instances are on local residential streets with small pockets of commercial use. The instance on West 46th Street demonstrates that ABLs are compatible with transit use as there is a bus line on this street.

Minneapolis' criteria for ABL installation are:

- Speed limit 30 mph or less (nearly all Minneapolis local streets have 30 mph speed limit)
- ADT under 6,000 vehicles per day
- Parking present on both sides of street

The City has encountered one issue with these installations. In the 14th Street case, drivers were initially unsure whether the street remained two-way, so signage was installed to indicate two-way travel at some intersections.



14th Street in downtown Minneapolis

Edina, MN

The first advisory bike lanes were installed in Edina in 2012 on Wooddale Avenue. This installation was subsequently removed after City staff determined they were not functioning as intended.¹⁷ The main issue with this installation was that the adjacent parking lane was rarely occupied, presenting a confusing situation to bicyclists and drivers as to where bicyclists should ride. Drivers expected bicyclists to ride in the empty parking lane, and some bicyclists felt uncomfortable maintaining their position 10' from the curb in the advisory lane when the parking lane was empty.¹⁸ Advisory bike lanes installed elsewhere in the city have been successful and continue to be in place on West 54th Street in Edina.

¹⁷ <http://current.mnsun.com/2013/03/26/edina-council-agrees-to-change-wooddale-bike-lanes/>

¹⁸ <http://streets.mn/2013/04/17/advisory-bike-lanes-on-wooddale-ave-to-be-removed/>

Alexandria, VA

Alexandria has the only local example of advisory bike lanes. These lanes were installed on Potomac Greens Drive in 2015 in order to provide a connection between two existing bike facilities. The street width varies and is 42 feet wide at the narrowest point, and stakeholders wanted to preserve parking on both sides. This results in 26 feet remaining for two-way travel for both automobiles and bicycles which is divided into two 5-foot bike lanes and a 16-foot two-way travel way for automobiles.



Potomac Greens Drive in Alexandria

Hanover, NH

Hanover installed its advisory bike lanes as part of a Safe Routes to School effort. These lanes provide space for bicyclists and, in some instances, pedestrians. (Right-of-way is not available for provision of separate pedestrian facilities in the form of sidewalks.) The street where they have been applied is a very low-volume neighborhood residential street with no sidewalk. Prior to installation, pedestrians and bicyclists did ride and walk in the street, but the addition of striping has provided a level of comfort that did not exist before. Parking is sometimes allowed in the advisory bike lanes during events at the nearby sports center, but this is not documented as a major issue. Unlike other U.S. locations, Hanover has also included signage to indicate appropriate yielding patterns for the advisory bike lane street.



Signage in Hanover, NH.¹⁹

Ancillary Benefits: Reduced speed and automobile volume

Where jurisdictions have removed centerlines to install advisory bike lanes, there is some evidence of both lower automobile traffic speeds and decreased automobile volume. A study by Transport for London found an average decrease of approximately 6 mph with advisory bike lane installation.²⁰ A study in Suffolk County, England found a decrease in ADT from 5,600 vehicles/day to 4,500 vehicles/day post installation²¹. The Dutch Institute for Road Safety Research also found a small decrease in automobile speeds with implementation of advisory bike lanes on rural roads.²² These rural roads would be similar to some narrow, low-volume roads located in parts of western and northern Montgomery County.

¹⁹ Copyright 2014 The Dartmouth, Inc. All rights reserved. Reprinted with Permission.

²⁰ <http://content.tfl.gov.uk/centre-line-removal-trial.pdf>

²¹ http://www.apbp.org/?page=2009_2_Advisory

²² <http://www.swov.nl/rapport/R-2003-17.pdf>

Criteria for Application in Montgomery County²³

There may be a limited number of locations where advisory bike lanes are appropriate in Montgomery County. Advisory bike lanes should be reserved for use in locations where space is limited and there is insufficient width to implement both standard bike lanes and vehicular travel lanes. This may result from a desire to maintain on-street parking. Planners and engineers will often be choosing among a number of facility types for lower-volume streets in these situations: primarily bicycle boulevards, shared lane markings and advisory bike lanes. Advisory bike lanes are preferable to other, similar facility types on low-speed roads, where prevailing traffic speeds are slightly higher (25- 30 mph versus 15-20 mph), traffic volumes are low, and where it is not possible to implement either the traffic calming and/or diversion features of a bicycle boulevard. The criteria listed below will help the County decide where to recommend advisory bike lanes. Additionally, this paper recommends five local examples for consideration in Montgomery County.

Number of Travel Lanes

The advisory bike lane facility is only applicable in conjunction with un-laned automobile travel lanes. Streets with existing centerlines will require the centerline be removed prior to the installation of the advisory bike lanes.

Street Width

The un-laned two-way travel space resulting from installation of advisory bike lanes should be 12 to 18 feet. The overall street width may vary based upon the presence of parking on one or both sides of the street.

Posted Speed

Advisory bike lanes should only be implemented on streets with speed limits of 30 mph or less. Most local streets in the county have a speed limit of 25 MPH, and many collector streets have a speed limit of 30 MPH.

Automobile Volumes

Every time automobiles pass each other in opposing directions, there is the potential for a head-on collision. On a road with 6,000 vehicles per day this would occur about every 15 seconds; for this reason the MUTCD requires roads with 6,000 or more vehicles per day to have a striped centerline, designating separate lanes for opposing traffic.²⁴ This should be the upper bound for streets where advisory bike lanes are recommended.

Reduction of the operating space for two automobiles through implementation of advisory bike lanes further complicates vehicle operations because of the need for yielding.²⁵ Given the number of times a bicyclist would experience being passed by an automobile, advisory bike lanes should be used on streets with 2,000 to 4,000 ADT. Above that traffic volume, the bicyclist may become uncomfortable, but the facility could be used on streets with 4,000 to 6,000 ADT as a more experimental treatment for study.

²³ Dimensional criteria for application will be further detailed in the Design Toolkit document that identifies minimum and preferred dimensions and the advantages and disadvantages of different configurations.

²⁴ See Section 3B.01 Yellow Center Line Pavement Markings and Warrants, Standard 09.

²⁵ Minneapolis has not seen increased head-on collisions where advisory bike lanes have been implemented.

Parking

Advisory bike lanes may be used on streets with or without on-street parking on one or both sides of the street. Where on-street parking exists, the critical criterion is the extent to which that parking is occupied. Low-occupancy parking lanes adjacent to the ABL may present a confusing situation to bicyclists and drivers as evidenced in the Edina example where drivers expected bicyclists to travel in the empty parking lane and some bicyclists felt uncomfortable maintaining their position outside the parking lane.

Land Use

The criteria laid out in the preceding sections will restrict Montgomery County's usage of advisory bike lanes to local residential streets. Unlike Minneapolis, it is unlikely there are urban commercial streets where these other criteria, especially traffic volume, are met.

Criteria Summary

- Number of motorists travel lanes: Un-laned, bi-directional travel
- Street width: will vary, but must result in un-laned travel way of 12 to 18 feet²⁶
- Posted speed: 30 mph or less
- Traffic volume: 2,000 to 4,000 ADT recommended; 4,000 to 6,000 ADT for experimental treatment with evaluation
- On-street parking: If parking present, should be majority occupied majority of the time
- Lane use: Local residential streets

Example Applications in Montgomery County

Each of these locations are possibilities for the application of advisory bike lanes. They were identified using the County's Bicycle Level of Traffic Stress analysis, street width measurements and a review of speed limits, adjacent land use and network connectivity. These are provisional locations pending traffic counts which would validate the applicability of advisory bike lanes.

- Olney Mill Road from Olney Laytonsville Road (MD 108) to Gold Mine Road
- Whittier Boulevard from River Road (MD 190) to Wilson Lane (MD 188)
- Indian Spring Drive from Caroline Avenue to University Boulevard (MD 193)
- Lambertson Drive from Arcola Avenue to Charlton Drive

²⁶ Advisory bike lane widths both with and without on-street parking will be detailed in the design toolkit.

3. Are Separated Bike Lanes a Replacement for Dual Bikeways?

The dual bikeway facility type was developed in the 2005 Montgomery County Bikeways Functional Master Plan to “meet the needs of the total range of bicyclists.” A dual bikeway consists of both an off-road sidepath and an on-street bicycle facility on the same street. In locations where space is available, the on-street facility is typically recommended to be a bike lane; where space is not available, the on-street facility it is typically recommended to be a signed shared roadway. The dual bikeway facility type is unique to Montgomery County and was recommended in locations where the County wanted to provide separation from high-speed, high-volume traffic for what today the industry refers to as *Interested but Concerned* riders, those who are less comfortable riding in an unprotected facility on those types of streets. The additional bike lane or shared roadway facility was provided to accommodate riders who are comfortable riding near or sharing the road with higher-speed, higher-volume traffic, who would prefer to travel at a higher speed, and who do not want to be impeded by slower moving bicyclists and pedestrians.

The advent of separated bike lanes provides Montgomery County with a new tool for accommodating a wide range of cyclists. This paper evaluates whether separated bike lanes are a replacement for the dual bikeway facility type in some or all situations.

Applicability of Separated Bike Lanes to Different Bicyclists

Bicyclists can be categorized based on how much separation from traffic they need to feel comfortable riding a bicycle. *Interested but Concerned* bicyclists express an interest in bicycling more, but are concerned for their safety. They require separation from traffic to feel comfortable riding on most non-residential roads. Separated bike lanes can be a replacement for the off-road portion of a dual bikeway since bicyclists are still physically separated from automobile traffic.

Confident bicyclists require less separation from traffic to feel comfortable riding a bicycle. On higher volume and higher speed roads, many would be comfortable bicycling in a conventional bike lane and some would be comfortable bicycling in traffic. They tend to be more concerned about the ability to travel unimpeded by pedestrians than physical separation from traffic. If designed appropriately, separated bike lanes can appeal to many confident bicyclists. For those confident bicyclists who would otherwise ride in a conventional bike lane, a separated bike lane is appealing if it is wide enough to allow faster bicyclists to pass slower bicyclists.

For those confident commuter bicyclists who would otherwise ride in the street, separated bike lanes can be appealing if they are designed to provide the same quality of riding environment as the street. Commuting bicyclists often ride during peak periods when traffic volumes are at their highest, so higher speed travel (up to approximately 18 mph) and the ability to pass other bicyclists should be considered in the design process. Of course some bicyclists in this group will always prefer riding in the street.

For those recreational bicyclists traveling in groups, separated bike lanes are not an appropriate facility because the space will be too confining for larger groups and higher speed bicycling. A group would potentially take over the entire width of a two-way separated bike lane, impeding oncoming traffic, and the width of a one-way facility would not allow for the typical passing movements conducted within a

group. Bicycling in the street would be more appropriate for this audience. These riders will also tend to ride on the high-volume, high-speed roads when traffic volumes are lower, such as weekend mornings, so the on-street facility will likely also be more comfortable.

In summary, if designed with sufficient separation from traffic, wide enough to enable passing and higher speed travel, separated bike lanes can be a replacement for dual bikeways for most *Interested but Concerned* bicyclists and many, but not all, confident bicyclists.

Recommendations for Montgomery County

1. Discontinue use of the dual bikeway as a facility type and utilize separated bike lanes or shared use paths in their place.

When dual bikeways are recommended as a combined shared use path and bike lane, they may be difficult or infeasible to implement due to space constraints in many locations. Furthermore, separated bike lanes can be considered enhancements over conventional bike lanes when designed to enable passing.

As discussed previously in the “Signed Shared Roadways” issue paper, signed shared roadways are not a bicycle facility type and are not recommended to be included in master plans. It is appropriate to use signs and pavement markings, such as Bikes May Use the Full Lane or sharrows, on roadways in Montgomery County, but these decisions should be made on a case-by-case basis at the time of implementation, not as part of the master planning process.

2. Select the appropriate separated bikeway type using the criteria established in the issue paper “When should separated bikeways be implemented as shared use paths or separated bike lanes?”

Separated bike lanes are not always needed to replace dual bikeways. In fact, shared use paths may be more appropriate in many contexts than separated bike lanes.

Pedestrian demand along the study corridor should be the primary consideration for practitioners choosing between the two facility types. Just as separation from automobiles enhances safety and comfort for people bicycling and driving, separation between people walking and bicycling may be necessary to eliminate potential conflicts and maintain a comfortable and attractive facility. Where observed or anticipated pedestrian demand is low, conflicts between people walking and bicycling may be infrequent. In this situation a shared use path may comfortably and safely satisfy both bicycle and pedestrian demand. Where pedestrian volumes are observed or anticipated to be high, separate facilities should be provided for bicyclists.

Some corridors may transition from shared use paths to separated bike lanes as land use becomes more mixed or commercial, thus attracting higher pedestrian volumes. These transitions are likely along corridors that are largely residential with periodic commercial nodes at intersecting arterial streets.

3. Consider use of Bikes May Use Full Lane (BMUFL) signage and/or sharrows where space constraints necessitate a shared use path rather than separated bike lane facilities.

The master plan should recommend a shared use path or separated bike lanes based upon an understanding of available right-of-way and the level of pedestrian activity. In some locations, space may not be currently available to implement the recommended separated bike lane facility, and a

shared use path could be constructed in the interim. Where this is the case, pedestrians and bicyclists will share limited space. On a case-by-case basis, the implementing agency should consider whether additional signage or markings on the street should be provided to notify drivers of the presence of bicyclists in the street who prefer to ride there than to share a congested path with pedestrians.

4. Consider use of Bikes May Use Full Lane signage and/or sharrows on known popular recreational group ride routes where separated bike lanes or shared use paths are provided.

On streets where shared use path or separated bike lanes are recommended in the master plan that are known popular recreational group ride routes, the implementing agency should consider whether to provide additional signage or markings on the street. Many recreational riders who ride these routes will do so during lower traffic off-peak periods and ride in the travel lane to travel at higher speeds. Drivers will be reminded that bicyclists may be present on the roadway and that they should change lanes to pass.

5. Ensure separated bike lane and shared use path design standards specify high-quality materials and construction.

These facility types will only provide an adequate substitute for on-street facilities for all rider types if they are designed to provide as high quality an experience as the street. Some existing off-street facilities are not constructed to an adequate width or quality such that all bicyclists view them as an adequate substitute for riding in the street. Proper width and construction can ensure that separated bike lanes or shared use paths are, in fact, replacements for dual bikeways. Separated bike lanes (whether in-street or outside the curb) and shared use paths should:

- Have proper drainage,
- Be designed and constructed with a quality subbase to minimize the development of surface defects and bumps over time and to provide same or better quality of surface as the adjacent roadway,
- Avoid grade changes at driveway crossings,
- Provide adequate width based on expected volumes of bicyclists (and pedestrians), and
- Include appropriate intersection design.

6. Where existing curb-to-curb widths permit provision of bike lanes by lane diets, implement bike lanes as an interim facility before construction of a separated facility OR where the existing sidepath is substandard.

Some confident bicyclists will feel comfortable in a bike lane facility even on higher speed, higher volume streets. Where it is possible to implement bike lanes cheaply and quickly, they should be added in locations where a separated facility is recommended in the master plan, or already exists as a substandard sidepath. These decisions should be made at the time of implementation, and bike lane space should be repurposed over time to provide the highest quality (widest pathway and buffer) sidepath or separated bike lane possible.

Examples in Montgomery County

The recommendations outlined above should be implemented consistently throughout the county on streets formerly identified as dual bikeways. The five corridors listed below were identified for dual bikeway facilities in the 2005 Master Plan. If the County desires to continue to include them in its

master-planned bicycle network, separated bike lanes or shared use paths should be the recommended facility type.

Most of the length of these corridors consists of low-density residential land use where most residences front on adjacent streets. These areas are more appropriate for a shared use path facility since there are not many generators of short pedestrian trips nearby. For each of the five corridors below, locations are identified where the County may wish to indicate a separated bike lane facility instead because of anticipated higher pedestrian volumes.

MCDOT or SHA may decide to implement sharrows or Bikes May Use Full Lanes signs, but these should not be recommended in the Bicycle Master Plan.

University Boulevard from New Hampshire Avenue to Georgia Avenue

- Commercial nodes: Columbia Pike, Georgia Avenue, New Hampshire Avenue
- School areas: Eastern Middle School, Montgomery Blair High School, Northwood High School

River Road from Western Avenue to Seven Locks Road

- Commercial node: Little Falls Parkway/Bethesda

Germantown Road from Clopper Road to Frederick Road

- Commercial node: Middlebrook Road

New Hampshire Avenue from Prince George's County to Lockwood Drive

- Commercial/mixed use node: White Oak
- Commercial node: University Boulevard, Ethan Allen Avenue

Norbeck Road from Georgia Avenue to Layhill Road

- Currently no major pedestrian generators

4. How Should Montgomery County Use Signed Shared Roadways in Master Plans?

Signed shared roadways are streets that are shared by both bicycles and motor vehicles. In Montgomery County, signed shared roadways are typically implemented with wide outside curb lanes (to provide space for motorists to pass bicyclists within the lane), bikeable shoulders on the side of the road, shared lane (“sharrow”) pavement markings, or on low volume / low speed streets. As Montgomery County moves forward with a new bicycle master plan that focuses on creating a connected, low-stress network, there is a question as to whether to maintain the signed shared roadway as a master-planned bikeway facility. This paper discusses the purpose of signed shared roadways, provides an overview of national guidance, evaluates the current use of signed shared roadways in Montgomery County, presents treatments that implement the signed shared roadway designation, and provides a recommendation for the County’s use of the designation moving forward.

Purpose of Signed Shared Roadways

Signed shared roadways serve three functions for bicyclists:

- Provide wayfinding,
- Are identified on a public bicycle map, or
- Provide some type of treatment on the roadway such as a sharrow and/or regulatory signage in the form of “Bikes May Use Full Lane” signs.

The first function, wayfinding, is helpful for bicyclists who are unfamiliar with the bike network. Wayfinding planning involves the identification of existing good bike routes and development of a detailed signage plan, whereas network master planning identifies the locations for future roadway improvements for bicyclists. Because of these differing goals, the two planning processes are best completed separately. Since it will likely take 10 to 20 years to implement many of the recommendations in a Master Plan, a separate wayfinding plan is needed to help direct bicyclists to major countywide facilities recommended in the master plan. Furthermore, in Montgomery County, wayfinding and network planning are each overseen by different agencies (MCDOT and M-NCPPC, respectively).

The second function, public bicycle maps, help riders navigate as well and is also not a master-planning function. The current Montgomery County bike map produced by the Department of Transportation includes “Bicycle Routes” that are derived from the signed shared roadways in the 2005 bike plan. However, the development of a public bicycle map should also be approached from a network planning perspective, identifying those streets that create a connected network of comfortable riding environments. Such maps may also identify routes and major street crossings by bicyclists’ level of traffic stress if routes of varying levels of stress are included. Given Montgomery County’s goal of creating a connected, low-stress network, the County may wish to produce a public map indicating level of stress for bicyclists as part of an effort separate from the Master Plan.

The third function, identification of locations where pavement markings and signage could be added to supplement existing shared lanes, are not a master plan function in this planning process. This is discussed in the following sections of this paper.

National Guidance on Signed Shared Roadways

The 2012 AASHTO Guide for the Development of Bicycle Facilities notes that shared lanes (another term for shared roadways) exist on all streets where bicycling is not prohibited and designated bicycle space does not exist. The Guide notes a number of characteristics—good pavement, adequate sight distances, bicycle-compatible drainage grates—that can make lanes more compatible with bicycling. It also notes that two street types are particularly suitable as shared lanes in their current situation:

- Streets with lower volumes and speeds
- Rural roadways with good sight distance, low volumes and operating speeds of 55 mph or less²⁷

Shared lanes may be accompanied by signage such as “Share the Road”, “Bikes on Roadway”, or “Bikes May Use Full Lane” signs. The “Share the Road” sign is starting to be discontinued by some transportation agencies, and FHWA recently issued guidance suggesting it is not a best practice.²⁸

Shared lanes, signed or unsigned, do not improve the bicyclist’s experience or change the amount of stress that bicyclists experience on a given street. For instance, the rural roadway example noted above would remain a high-stress environment owing to the speed of traffic.

The Guide further notes that route signage alone will not improve bicyclists’ safety because they do not provide any geometric design changes. In the upcoming update to the Guide, route wayfinding signage will be a separate section from bicycle facility types.

In reality, signed shared roadways are not themselves a facility type. Streets designated as signed shared roadways feature one (or a combination) of the bicycle treatments identified above (wide outside lanes, shoulders, sharrows or signage). The 2012 AASHTO Guide includes them in the bicycle facility types section, but the coming update of the guide will move signed shared roadways to a section on wayfinding.

Current Use in Montgomery County

Signed shared roadways have been included as a facility type in Montgomery County bicycle master plans for over 30 years. Currently, there are over 400 miles of roadways in the county designated in this manner. Signed shared roadways are primarily intended to serve a connectivity function in Montgomery County’s planned bicycle network, providing links between other bicycle facilities and destinations. Signed shared roadways were often included on streets where space does not exist to accommodate another exclusive bicycle facility type such as bike lanes or a shared use path. These streets were a combination of low-volume, low-speed neighborhood streets and low- to medium-volume, higher-speed streets that are the only option for connecting to certain destinations.

Some of the master-planned signed shared roadways have been implemented by the County Department of Transportation as wayfinding projects, others are merely indicated on the county bike map as shared roadways. In practice, designated signed shared roadways represent a wide range of street types and network purposes. Some signed shared roadways are so designated because they are

²⁷ Note: Maryland state law prohibits bicycling on roads with speed limits greater than 50 mph. While bicyclists may use the shoulder on these roads, they may only enter travel lanes if making a left turn, crossing the roadway, or if the shoulder is overlaid with a right turn lane, a merge lane, a bypass lane, or any other marking that breaks the continuity of the shoulder.

²⁸ http://mutcd.fhwa.dot.gov/knowledge/faqs/faq_part9.htm#signsq5

already low-speed, low-traffic streets, and some are designated because they are routes already used by bicyclists. Many in this latter category are high-speed roads with no bicycle facilities, which are generally considered high-stress streets for most bicyclists.

Signed shared roadways are implemented through five treatment types today in Montgomery County. The five treatments identified below include two types of signage (wayfinding and regulatory), and two facility types (wide outside lanes and shoulders). Sharrows, are not a facility type, but can provide multiple functions, are also discussed. The subsequent section makes recommendations about the County's use of each of these treatment types in the master planning process.

Signed Routes: Wayfinding

As discussed above, signed routes that provide wayfinding signage help bicyclists navigate the bicycle network. Additionally, if signage is focused only on existing comfortable routes that avoid high-stress crossings, such routes can help the *Interested but Concerned* part of the population understand how to access the network and navigate to their intended destinations and thus consider choosing to bike rather than travel by another mode. Wayfinding alone, without accommodation separated from vehicular traffic, is not a facility type that improves the bicyclist's comfort on a given street.



Montgomery County DOT has implemented some wayfinding routes

Signed Routes: Regulatory

Bikes May Use Full Lane (BMUFL) signs are regulatory in nature and govern the interactions of bicyclists and drivers on the roadway. This sign permits bicyclists to control the lane and requires that motorists either change lanes to pass or, if passing legally is not an option, wait patiently behind bicyclists. This signage may be used alone or in tandem with sharrow markings on the roadway. County policy regarding BMUFL signs follows the Maryland State Highway Administration Bicycle Policy and Design Guidelines.²⁹ As with wayfinding signs, regulatory signs without accommodation separated from vehicular traffic are not considered to be a facility type because the signs do not improve bicyclist's comfort.



Bikes May Use Full Lane signs may be used in tandem with sharrow markings.

Shared Lane Markings (“Sharrows”)

Generally, sharrows serve three primary purposes: 1) Operational: to indicate the recommended location within the travel lane for bicyclists to use; 2) Regulatory: provide a visual cue to remind drivers that bicyclists may be present; and 3) Wayfinding. None of these three functions are master planning functions, but rather considerations for implementation.

It should be noted, however, that implementation has varied among different jurisdictions. For instance, Portland, OR has decided to use sharrows primarily as a wayfinding marking and only on low-volume, low-speed streets. This usage includes bicycle boulevards where additional traffic calming and/or diversion is present. Most other jurisdictions use sharrows to fill gaps in the network, regardless of

²⁹ http://roads.maryland.gov/ohd2/bike_policy_and_design_guide.pdf

traffic volume, where other dedicated facilities do not exist. In many cases these are located on higher volume collectors or arterials. To date, Montgomery County has not explicitly identified the function of sharrows in the bicycle network, but the County may wish to explore defining appropriate uses of sharrows through the Bike Master Plan.

Within Montgomery County, sharrow markings are used on a wide variety of roadway types, including roadways formally designated as shared roadways in the 2005 Countywide Bikeways Functional Master Plan as well as other roadways not formally designated through the Plan. This may be due, in part, to different transportation agency jurisdiction over roads within the county (e.g. MDSHA and MCDOT). For instance, in Silver Spring, MCDOT installed sharrows on the block of Ellsworth Street between Fenton Street and Spring Street. This location has two travel lanes and relatively low traffic speeds and volumes. To pass bicyclists, drivers must encroach on the oncoming travel lane, meaning they must often slow when passing the bicyclist. MDSHA installed sharrows on Georgia Avenue, a state highway, just a few blocks away from the Ellsworth Street in Silver Spring. This street has six lanes of high volume traffic that often travels at high speeds outside of congested hours. To pass bicyclists on Georgia Avenue, drivers can encroach on an adjacent travel lane, in the same direction or change lanes entirely, which enables drivers to maintain higher speeds.



Sharrows indicate an appropriate path of travel to bicyclists and encourage drivers to move over to pass.

Bicyclists can tell the difference between roadway types where sharrows are used today (e.g., Ellsworth Street vs. Georgia Ave) and will not be confused by the application of the same facility on widely varying street types. Adult bicyclists can see that traffic volumes and speeds are very different on these two streets and that sharing space with traffic on each street will be a different experience. Sharrows can serve a function for bicyclists in both situations, however, given the Bicycle Master Plan goal of creating

a low-stress network, sharrows should only be considered as part of the toolkit for implementing bicycle boulevards on low-volume, low-speed streets and as an interim treatment.

Wide Outside Lanes

Wide outside travel lanes are intended to provide space for both bicyclists and drivers to operate in tandem within the same lane. Standard traffic lanes in Montgomery County are 11 to 12 feet wide, while a wide outside lane is 14 to 14.5 feet wide. Consensus has grown in the bicycle planning and engineering field that wide outside lanes do not constitute a facility type. Though more space is provided for a driver to pass a bicyclist, this additional width does not increase a bicyclist's comfort, especially on roadways with high speeds. Additionally, wide lanes tend to increase automobile travel speeds, and may actually make bicyclists less comfortable next to higher speed traffic than on a similar roadway with standard width lanes. Although wide outside lanes were included in the 2012 AASHTO Bike Guide, they are not likely to be included in the upcoming release of this guide. In Maryland, most wide outside lanes were implemented by MDSHA on high-speed, high-volume roadways, but the agency is moving away from viewing wide outside lanes as a bicycle improvement because of better understanding that they do not improve bicyclists' comfort. Although MDSHA does not prioritize the implementation of low-stress bicycle facilities, MDSHA recognizes that a bike lane or shoulder provides a higher level of comfort than a wide outside lane. Some wide outside lanes were also implemented by MCDOT in the past in similar locations.



Wide outside lanes provide more space for drivers to pass bicyclists but do not change the level of comfort experienced by most riders.

Shoulders

A bikeable shoulder is a space outside of the vehicular travel lanes that can be used by bicycles when not occupied by stopped or parked vehicles. Bikeable shoulders can improve comfort on some roadways for some bicyclists, but are not technically a shared roadway because the shoulder provides space for bicyclists outside the automobile travel lane.³⁰ Shoulders are more likely to be present in more outlying locations in the county often where posted speed limits are 40 mph and higher.³¹ Shoulders of at least three feet provide some space for bicyclists to avoid riding in the automobile travel lane. Additional width provides a greater level of safety and comfort for bicyclists as they are able to ride farther away from adjacent automobile traffic.



Paved shoulders are present on some rural roads in the county.

Recommendations for Montgomery County

The following recommendations are based on a review of past County planning practices and emerging national best practices, and are provided to inform the Montgomery County Bicycle Master Plan:

1. Discontinue use of signed shared roadway as a facility type.

Signed shared roadways are not a facility type and should not be identified as such. Rather, they are implemented through the treatments identified above. The purpose of a master plan is not simply to

³⁰ Implementation of bikeable shoulders is often inconsistent, resulting in variable effective widths for bicycle operation. As a result, bicyclists will often be forced to transition into the automobile travel lane, where shoulders narrow or drop, and share the lane with automobiles.

³¹ These speeds create higher stress levels for most bicyclists, but riders who are more tolerant of higher traffic stress may be comfortable on roads with higher speeds where either traffic volume is low or shoulders are present.

identify streets that connect to one another and to destinations, but to identify a set of infrastructure recommendations that will improve the comfort of bicyclists on those streets. With Montgomery County's goal of creating a connected low-stress network, bikeway recommendations should only include those facilities that will create a low-stress environment on streets, no matter what their traffic and roadway characteristics. National best practice among bicycle planners and designers has come to this conclusion since the last County bikeways plan in 2005. Updating the County's approach to signed shared roadways will keep pace with national best practices.

2. Recommend the development of a comprehensive wayfinding plan for the County.

Wayfinding should be addressed as a separate planning process from the master plan. Implementation of wayfinding routes is already underway in the County and has been based, in part, on prior identified signed shared roadways. However, in developing the detailed sign plans for routes, planners have found needs to deviate from the identified routes to take advantage of more comfortable crossing locations. A wayfinding plan could help the County identify destinations people will want to access and subsequently identify the most suitable routes for bicycling to those destinations. This effort could also help refine the County's bike map.

3. Discontinue use of signed routes in the master plan.

Neither regulatory signage alone in the form of Bikes May Use Full Lane signs, nor wayfinding signs improve the comfort or connectivity of streets. The identification of signed routes should be completed through a wayfinding plan. The County may wish to consider use of BMUFL signs on a case-by-case basis as discussed in the dual bikeways issue paper.

4. Discontinue use of wide outside lanes as a facility type.

Wide outside lanes do not improve the comfort of a road for bicyclists and may, in fact, decrease comfort by leading to increased automobile travel speeds. This facility type is not compatible with the County's goal of providing a low-stress network. The County should consider restriping wide outside lanes as narrowed lanes with shoulders if three feet are available for shoulder width. Striped shoulders have been shown to increase bicyclists' comfort even if the total width of the outside lane and shoulder are the same as a wide outside lane, i.e, 11-foot travel land and 3-foot shoulder versus a 14-foot travel lane.³²

5. Develop a sharrow use policy.

The County currently does not define the purpose of shared lane markings in its network. The County should develop a sharrow use policy and may frame that policy based upon the two uses outlined below: 1) as part of bicycle boulevards, and 2) as an interim treatment. Both of these uses will be decided by the implementing agency at the time of facility design and are not expected to be outlined in the Bike Master Plan. Sharrows may be appropriate in a range of situations but should not be recommended as an independent facility type in this Master Plan.

³² The Bicycle Level of Service methodology says that riders who were part of that study indicate an increased level of comfort with shoulder striping. This may not increase comfort for all riders, but some, likely more confident riders, will feel more comfortable in the restriped context.

Sharrows may be a treatment option on low-volume, low-speed streets designated as bicycle boulevards. In this context, sharrows can serve a wayfinding function and also reinforce bicyclists' right to control the lane.

Additionally, sharrows may be a treatment that is used as an interim marking on streets master-planned for other facilities. For instance, a street may be designated for a separated bike lane and serve a critical network function in connecting to major destinations or other pieces of the bicycle network. However, implementation of the separated bike lane may take years, and in the intervening time, a sharrow can help a segment of the bicycling population navigate high-speed, high-volume roads. The sharrow marking would indicate to drivers that they should expect bicyclists and should change lanes to pass.

6. Recommend other bicycle facilities on some local streets formerly identified as signed shared roadways.

Connectivity is one of the most important characteristics of a bicycle network. Signed shared roadway recommendations in the past have consisted, in part, of local streets that are already comfortable for bicycling. However, these route recommendations were not restricted to those fully connected low-stress routes with comfortable crossings of major streets. Bicycle boulevard, advisory bike lane and/or sharrow recommendations should appear as part of the County's network to improve the comfort of streets. Additionally, the plan should identify those locations where crossing improvements (i.e., signals, medians, crosswalks, etc.) are necessary to provide low-stress crossings that connect low-stress streets to one another.

5. Separated Bike Lanes v. Shared Use Paths

Once the decision to provide physical separation from traffic is made, practitioners must then determine whether to provide a separated bike lane or a shared use path. Separated bike lanes and shared use paths are both critical components of low-stress bicycling networks that are designed to appeal to all ages and bicycling abilities. Both increase the safety, comfort, and attractiveness of the bicycling environment by physically separating bicyclists from motor vehicle traffic, and both facilitate direct and convenient connections to destinations, transit services, and other bicycle facilities. However, each has practical differences in context, design, and application.

Separated bike lanes are an **exclusive space for bicyclists** along or within a roadway that is physically separated from automobiles and pedestrians by vertical and horizontal elements. Separated bike lanes may be constructed as a one-way pair located on both sides of the street in the direction of travel, or they may be constructed as a two-way bikeway. Two-way separated bike lanes can also be constructed in the center of a two-way street; however, this design is generally not preferred because it creates more potential points of conflicts between turning automobiles and bicycles, separates bicyclists from destinations along the roadway, and places bicyclists between opposing directions of traffic. Space constraints will often dictate which facility is feasible in retrofit situations where moving curbs or expansion of the right-of-way is not possible. Design considerations for separated bike lane configurations are addressed in the facility toolkit that will inform Master Plan facility decisions.

Shared use paths provide a **shared space for all non-motorized users** (e.g., people bicycling, walking, jogging, skating, etc.). They are often referred to as sidepaths when parallel to a roadway within the right-of-way or trails when located along another alignment. Shared use paths provide for two-way travel in all cases and are often marked with a centerline to distinguish directionality.

Recommendations for Montgomery County

The decision to provide a shared or separated bicycle space should be supported by a planning process to analyze benefits and tradeoffs, facility configuration, and feasibility given corridor constraints. The following discussion outlines the critical considerations for choosing between a separated bike lane and shared use path facility.

It should be noted that these criteria are general in nature and leave many design decisions to the planners and designers at time of facility implementation. Additional factors such as right-of-way availability, utility location constraints, adjacent property owners' desires and others will weigh in the decision between implementation of a separated bike lane or shared use path. These recommendations provide a general framework for considering this choice.

Additionally, planners should use these recommendations with an eye toward anticipated and desired pedestrian and bicycle volumes on a given corridor. A given corridor today may not have high pedestrian volumes, but with the addition of more varied and active land uses, that may change. Planners should

also note that future separated bike facilities may induce more bicycle trips by helping additional people choose to bicycle for their trip rather than driving. A lack of bicyclists today in a corridor should not be an indication of a lack of latent demand.

Considerations for Separated Bike Lane v. Shared Use Path Choice

Pedestrian demand along the study corridor should be the **primary consideration for practitioners**. Just as separation from automobiles enhances safety and comfort for people bicycling and driving, separation between people walking and bicycling may be necessary to eliminate potential conflicts and maintain a comfortable and attractive facility. Where observed or anticipated pedestrian demand is low, conflicts between people walking and bicycling may be infrequent. In this situation a shared use path may comfortably and safely satisfy both bicycle and pedestrian demand. Where pedestrian volumes are observed or anticipated to be high, separate facilities should be provided for bicyclists.

The density and land use of the surrounding environment is closely related to pedestrian demand. Providing separated bike lanes and sidewalks is recommended along “main street” town centers and urban streets. Bicycle movements would conflict with both higher pedestrian volumes in these areas as well as the meandering and stop-and-go pedestrian movements associated with urban areas (e.g., socializing, shopping, dining outdoors, accessing transit or on-street parking, etc.). In urban areas, storefronts and other building entryways open directly to the sidewalk, further necessitating separate pedestrian and bicycle spaces. In Montgomery County, this will apply to commercial and higher-density mixed use areas and those around major transit facilities.

This guidance is already being followed in small area network plans for urban areas of the County such as Bethesda, White Flint and Silver Spring. Right-of-way outside the curb will also likely be more constrained in built-out urban areas and may weigh heavily in facility decisions; however, creating a comfortable facility for both bicyclists and pedestrians should remain the primary consideration.

Land uses in suburban and lower-density communities are more spread out, which reduces demand for walking and, subsequently, conflicts with people bicycling. Shared use paths may be appropriate in these contexts. Single-use residential areas, even those that are somewhat more dense, are especially more well-suited for a shared use path application because the lack of nearby destinations will lead to fewer short walking trips. Even in corridors with bus service where pedestrians will board and alight on the path, pedestrian volumes will most likely be low and sporadic enough to avoid frequent conflicts with bicyclists.

Consideration³³	Shared Use Path (SUP)	Separated Bike Lane (SBL)
Estimated or Anticipated Pedestrian Volumes	Lower pedestrian volumes	Higher pedestrian volumes
Land Use Character	Less dense development, especially suited to suburban or rural areas, or bounding undeveloped land	More dense development, especially commercial and mixed-use

[Example Application in Montgomery County: Falls Road](#)

Falls Road (MD 189) is a two-lane arterial in the southwestern portion of Montgomery County. It connects MacArthur Boulevard at the western end to Maryland Avenue at the eastern end approaching downtown Rockville. The street expands to a median-separated four-lane cross section as it approaches I-270 and narrows again on the approach to Rockville.

The posted speed limit is 35 mph, and shoulder width on both sides of the road varies frequently between approximately one to four feet. These characteristics make Falls Road rate a high stress road today. A substandard width shared use path exists on Falls Road from MacArthur Boulevard to River Road. Another, wider section of shared use path exists from Dunster Road to Wooton Parkway. These two facilities provide a lower stress bicycling environment in those segments, but they are disconnected.

Land use is primarily single-family residential (fronting on side streets) along its approximately seven-mile length, with the exception of the commercial center at Potomac Village and interspersed school, religious and recreational uses (e.g., Falls Road Golf Course, Falls Road Park). Pedestrian volumes are low along the corridor; little commercial use is located nearby that would generate short pedestrian trips except in Potomac Village and the existing shared use paths for recreational use. Pedestrian volume is also likely to be generated along the corridor would RideOn buses 47 and 56 close to Rockville, and WMATA bus T2 from River Road north.

Given the low-density land use characteristics and low anticipated volumes of pedestrians along the Falls Road corridor, the appropriate bicycle facility would likely be a shared use path. A shared facility here would enable both bicyclists and pedestrians to utilize the facility with little anticipated conflict. Additionally, such a facility would provide access to destinations mentioned above and to the existing shared use path network.

³³ An additional criterion often raised is the presence and frequency of driveway crossings. Both separated bike lanes and shared use paths can be designed to standards that minimize and mitigate conflicts between bicyclists and drivers at these crossings. Drivers entering/existing driveways may encounter bicyclists along the road edge in bike lanes or in a shared lane situation as well. Driveway frequency may, however, be one criterion when choosing a side of the street for construction of a two-way separated bike lane or a shared use path. This must be weighed against bicyclists’ access to the destinations for which the facility is constructed in the first place.

6. Two-Way Bikeways on Both Sides of the Street

Separated bike lanes and shared use paths can both provide two-way travel for bicyclists. In some situations two-way separated bike lanes or shared use paths on both sides of the street (i.e., a two-way pair) may be warranted. The general application for this facility type is along wide, higher-speed, higher-volume streets with limited crossing opportunities where destinations exist on both sides of the street. Two-way bikeways on both sides of the street minimize the need to cross wide roadways, travel excessive distances to cross at a safe location, and improve access and network connectivity to both sides of the street.

Conversely, two-way bikeways on one side of the street and one-way separated bike lanes on both sides of the street limit access for bicyclists. A single two-way bikeway, while potentially beneficial to connect to some destinations along the corridor or connecting bicycle facilities, can require bicyclists to cross the roadway twice to reach their destinations and limits access to the other side of the street. This may lead to wrong way riding at locations where the main road is perceived as a barrier to cross or results in excessive delay to cross. Similarly, a pair of one-way facilities on each side of a street may present a problem if a bicyclist's destination is on the opposite side of the street from his direction of travel. This requires the rider to either cross the street twice to access the destination, or it may lead him to ride against traffic on the side of the street where his destination is located.

By providing a two-way facility on each side of the street, Montgomery County will enable bicyclists to complete trips to their destinations with minimal conflicts and delay and encourage more *Interested but Concerned* riders to consider choosing bicycling.³⁴

Domestic Examples

Domestic examples of two-way bikeways on both sides of the street are uncommon. Hiawatha Avenue in Minneapolis, a high-speed six-lane limited-access highway, is bound by two shared use paths between E 24th Street and E 26th Street. This bike facility configuration enhances network connectivity significantly by directly connecting the non-motorized overpasses at these cross streets to the north-south Hiawatha Bike Trail and the east-west Midtown Greenway. Bicyclists avoid crossing Hiawatha Avenue at-grade entirely, eliminating conflicts with vehicles and creating a comfortable bicycling environment.



Redesigned Casey Arborway (path connections in blue)

³⁴ Interested but Concerned riders are more comfortable when given greater separation from high-speed, high-volume traffic. They comprise approximately 60% of the population

Two-way facilities on both sides of the street are currently under construction in Boston as part of the Casey Arborway Project. The completed Arborway will span at least six lanes of heavy motor vehicle volumes, and is located alongside regional path connections. The two-way bikeways on both sides of the street will minimize the need to cross the Arborway while upgrading existing connections to the Southwest Corridor and creating new east, west, and south non-motorized path connections.

International Examples

Two-way facilities on both sides of the street are more common abroad. The Dutch, in particular, make extensive use of this arrangement inside built-up areas where dense bicycle networks are the norm. Typically, two-way facilities on both sides of the street are limited to divided roadways with raised medians (often occupied by light rail tracks) and higher motor vehicle speeds and volumes. Vierhavensstraat in Rotterdam was recently reconstructed as part of a redevelopment effort and includes two-way facilities on both sides of the street.



Vierhavensstraat, Rotterdam, Netherlands

For the Dutch, the implementation of two-way facilities on both sides of the street is a logical outcome of the development of bicycle networks. This comprehensive planning process is guided by five fundamental requirements in the Netherlands: cohesion, directness, safety, comfort and attractiveness:

- *Cohesion*: Does the bicycle network connect origins and destinations, and align with existing bicycle travel patterns? Two-way bikeways on both sides of the street simplify and enhance access for bicyclists by eliminating the need to cross the street. They may be implemented to better align to existing bicyclist travel patterns, ensuring that the bicycle network serves at least 70 percent of all bicycle trips. The grid of the bicycle network should include facilities spaced at no greater than 250 meters (820 feet) apart.
- *Directness*: Does the bicycle network facilitate trips that are as direct and unimpeded as possible? Two-way bikeways on both sides of the street promote directness in distance and time by minimizing the need to unnecessarily cross the street and detour from the desire line. The detour factor—a comparison of route length and as-the-crow-flies distance—should be no

greater than 1.2 for main cycle routes and 1.4 for additional routes. Stopping frequency—stops per kilometer—should be minimized.³⁵

- *Safety*: Are conflicts with crossing traffic avoided? Two-way bikeways on both sides of the street minimize the need to cross multiple lanes of higher speed traffic. This minimizes exposure to dangerous conflicts. The safest conflict is the one that doesn't exist.
- *Comfort*: Does the bicycle network prevent exposure to “traffic nuisance”, defined by the Dutch as negative impacts of interacting with automobiles, such as exhaust, noise pollution and conflicts resulting in delay? Two-way bikeways on both sides of the street minimize encounters with automobiles by separating bicycles and cars to a great extent within the same corridor.
- *Attractiveness*: Does the bicycle network attract continued use? Two-way pairs separate bicyclists from motor traffic to a greater extent and increase bicycle access and connectivity. This can make trips more convenient by bicycle. Two-way facilities also encourage side-by-side riding, which promotes social interaction and, ultimately, enjoyment.

Recommendations for Montgomery County

A two-way bikeway on both sides of the street is intended to serve a unique function within the County's bicycle network. This facility type should only be recommended where *all* recommended criteria are met because of the significant level of investment needed to implement these facilities.

Additionally, other network and roadway reconfiguration options should be investigated before settling on the choice to recommend a two-way bikeway on both sides of the street. Parallel routes on lower-volume, lower-speed streets may be available and feasibly implemented with a lower level of investment. Planners should also consider whether changes are feasible to the street in question: Is it possible to add more safe, comfortable crossings? Is it possible to reduce the number of travel lanes and make crossing easier? These types of changes may not be feasible in retrofit projects, but the design process of a street in a newly developing or redeveloping area should take these questions into consideration.

It should be noted that a two-way pair may be used for a short segment within a commercial area and transition back to a two-way facility on one side of the street outside of this area. These segments can provide critical connections and access for bicyclists on major streets that may otherwise create a barrier.

Recommended criteria for application of two-way bikeways on both sides of the street are:

- Long distances between safe, comfortable crossings (typically 800 to 1000 feet³⁶)
- Wide automobile travel way cross section (four or more lanes), and
- Presence of destinations/active land uses on both sides of the street.

³⁵ This logic becomes important for short trips, such as those the County may desire to capture within a mixed-use neighborhood. Undue delay on a quick run for errands will dissuade a resident from choosing to bike instead of drive.

³⁶ Lower thresholds may be considered where a high density of destinations exists on both sides of the street.

Long distances between crossings where destinations are present on both sides of the street may lead bicyclists to undertake different unsafe behaviors based upon configuration of the bike facility provided:

- One-way pairs (conventional or separated bike lane): Bicyclists may ride against traffic in the one-way facility to avoid crossing the street to reach their destination. However, their movements would not be accommodated in the design of the facility either in width (for passing) or signage and marking (for alerting drivers).
- Two-way facility (shared use path or separated bike lane) on one side of the road: Bicyclists may cross at unmarked crossings which drivers will not expect and which poses a greater risk on wide, high-speed roads. Bicyclists may also ride on the sidewalk on the non-bicycle facility side of the street leading to increased conflict with pedestrians in this limited space and to conflicts with automobiles entering/exiting from driveways where bicyclists are unexpected.

A street must have a wide cross section, four lanes or more, to consider this facility application. The width of the street makes crossing less safe through exposure to multiple lanes of traffic and likely higher speeds. Wider streets often also have longer signal phasing which presents further delay to bicyclists who may need to cross the street twice to reach their destination and continue a trip if a facility is only provided on one side of the street.

The criteria for crossing distances are only applicable where a bicyclist has a reason to access both sides of the street. A street that meets the other criteria would not warrant two-way facilities on both sides if it abuts a large private property or a park with one entrance, for instance. Corridors with destinations on both sides of the street are likely to have commercial or mixed-use land use.

Many locations that meet the criteria for two-way facilities on both sides of the street will also have high pedestrian volumes owing to the density of destinations and likely coincidence of transit lines along the corridor. In most cases, this will mean separated bike lanes are preferred to help alleviate conflicts between pedestrians and bicyclists.

[Example Application in Montgomery County: Rockville Pike](#)

Rockville Pike is perhaps the quintessential example of a street that is well-suited to a two-way pair facility due to the distance between safe, comfortable crossings, wide street cross section and presence of active commercial destinations on both sides of the street. The White Flint Separated Bike Lane Network calls for a separated bike lane on Rockville Pike, but this planning documents does not specify cross sections for these recommendations to provide flexibility in implementation.

Rockville Pike is a six-lane street in this segment, though turn lanes increase this width at every intersection, and this width creates a major barrier to accessing both sides of the street. Safe, comfortable crossings are farther apart than is practical for bicyclists making short neighborhood trips in this area. Crossings are, on average, 850' apart from one another, a distance which slightly exceeds the threshold stated above. Commercial destinations are located on both sides of the road throughout

White Flint today, and anticipated redevelopment will only intensify these land uses and bring a greater number of residents to the area. Businesses front on Rockville Pike, and while some access may be possible from side streets in the network, two-way facilities on both sides of the street will enable bicyclists (and non-bicyclists) to conceptualize arriving at these businesses by bicycle.

The two-way pair would be recommended to begin at Flanders Avenue—the beginning of commercial use on both sides of the street—on the south end, and continue to meet the two-way pair at the Rockville city line. On Rockville Pike and at other locations in the county, trade-offs would need to be made to accommodate the increased space needs for two-way facilities on both sides of the street. If two-way bikeways are not provided on both sides of the road through the White Flint area, it can be expected that people will be less likely to choose to bike for their trip, bicycle on the sidewalk, or bicycle in the wrong direction on a one-way bikeway. These possible outcomes are in conflict with the County’s goals for providing a safe, connected, low-stress network that attracts more residents and visitors to choose bicycling.