CITY OF LAUREL
BIKEWAY MASTER PLAN

Adopted - September 2009
Revised - March 2016 - DRAFT

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Department of Public Works

PREFACE

In recognition of the City of Laurel's increasingly mobile population, its many retail offerings, and expansive public park system, Mayor Craig A. Moe placed into action his vision to provide a safe and viable means for pedestrians and bicyclists to safely and easily navigate City streets. Based on his vision, City Staff were directed to develop a Bikeway Master Plan that builds new bikeways and utilizes existing roadways in a shared manner to accommodate bicyclists – the same way that existing sidewalk repair/augmentation programs aid pedestrians.

Therefore, with the opportunity to see his vision fulfilled, Mayor Moe was proud to present the draft of the Bikeway Master Plan to the citizens for public comment in summer 2009. Later in September 2009, the Mayor and City Council of Laurel officially approved and adopted the "City of Laurel Bikeway Master Plan." While the Plan involves modifying many of the City's streets, Mayor Moe indicated that Fourth Street, which connects the City's two most used parks, would be the beginning path for the Plan.

Through the past eight years' of implementation, there is now a total of approximately seven (7) lane miles of bikeways in the City. Further implementation of the Plan will occur on Van Dusen Road from Killbaron Drive to Contee Road and on Laurel Place from Cherry Lane to Mulberry Street. Both bikeway projects are under the grant agreement with the Maryland Department of Transportation (MDOT) Bikeway Program. Future bikeways will occur as budgets permit. The adopted Bikeway Master Plan will be an adjunct to the City's Master Plan, the Capital Improvement Program (CIP), and will be part of the Adequate Public Facilities review for all future developments.

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1. Introduction - What is a Bikeway Plan?

A bikeway plan, at its core, consists of establishing and maintaining infrastructure and the culture for the bicycling mode of transportation, much like the city's roadway network for cars or the system of sidewalks and crosswalks for pedestrians. A bikeway is any street, trail, or shared-use path that has been designated for allowing and accommodating bicyclists. The infrastructure serves as a means of safe and efficient transportation and parking for bicyclists. The goal of this bikeway plan is provide a roadmap and design guide for implementing this infrastructure within the City of Laurel to allow bicyclists in any neighborhood to safely and comfortably reach any other City neighborhood as well as reach any City park, school or retail core area. Criteria for selected bikeways are outlined with a mathematical approach to maximizing travel efficiency and user safety. Design guidelines and policy recommendations are also addressed.

2. Why to Have One?

Laurel is a compact city of about twenty-five thousand people in a space of 4 square miles. It is also a city replete with public amenities, including many public parks, two city pools, and five public or private schools, in addition to multiple commercial/retail areas both large and small. Because Laurel is compact and has many local destinations, biking can be a preferred alternative to driving, provided that a safe and convenient infrastructure exists. The City of Laurel's density and amenities make it an ideal candidate for incorporating bikeways into its existing transportation infrastructure.

Given that Laurel is only two miles wide and its parks and core retail are centrally located, many destination-based bike trips can be made in less than 10 minutes. In fact, depending on the prevailing traffic congestion conditions, biking to local destinations can be faster than driving. From a traffic capacity perspective, incorporating bikeways is far more efficient than expanding roadways. Excess vehicle capacity from roadway widening projects quickly gets consumed by new upstream developments or by motorists seeking the most efficient route, such that pre-existing traffic congestion levels quickly return. However, bike lanes are far smaller than vehicle lanes, require much less asphalt to support, and require much less right-of-way. Additionally, parking for bikes is more efficient than vehicle parking; a single standard 9 ft. by 20 ft. parking space can hold parking for 10 bicycles.

If a dedicated and safe bikeway network existed in the City, the increased biking that would follow would have a substantive reduction in congestion through and around the City. A quarter of all car trips in the United States are less than 1 mile in length, yet only 1 percent of all trips are by bicycle (US DOT 2003). Traffic congestion is based on vehicle volume. However, this relationship is not linear. Highway capacity analysis shows that, once certain critical volume levels are attained, additional vehicles have an even *greater* impact on congestion (delay), such that only a few vehicles can mean the difference between minor delays and massive delays – particular in an urban setting with many traffic lights and closely-spaced intersections. Figure 1 shows the nominal relationship between vehicle volume and congestion/delay.

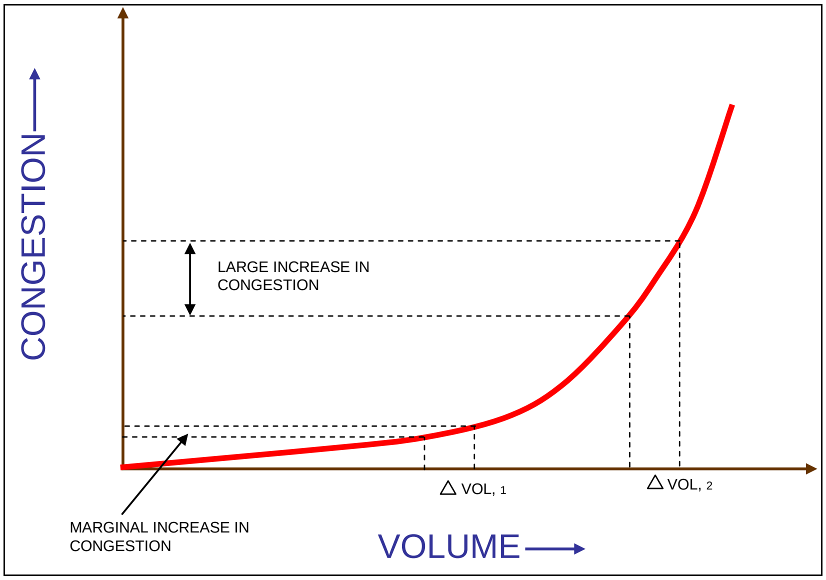


Figure 1: Illustration showing the effect of incremental vehicle volume on congestion.

As shown in the figure above, additional vehicles (Δ vol_1) result in only marginal increases in congestion when overall volume is low, but at higher volumes, the same number of additional vehicles (Δ vol_2) result in a much higher increases in congestion (delay). Once traffic volume reach a critical level, *taking these added vehicles off roadways by providing biking as an alternative* can prevent massive delays to motorists.

Finally, biking is far healthier and cheaper than driving. Biking requires no fossil fuel or other external energy generation. It results in no air/noise pollution. The cost of bike ownership (initial purchase, fuel, repair costs and insurance) is negligible compared to passenger vehicles.

In sum, a bikeway plan provides:

- A safe and efficient connection between neighborhoods and with Laurel's numerous City parks and other public facilities or retail.
- A continuous link with other surrounding jurisdictions' existing or planned bikeways.
- Efficient use of existing infrastructure and right-of-way to maximize vehicle (car and bike) capacity.
- A reduction in vehicle traffic congestion.
- A reduction in air and noise pollution.
- A healthier, fitter populace.
- An opportunity for more personal interaction among neighbors.

3. Bikeway Infrastructure Elements and Design Guidelines

A Bikeway Transportation Plan provides the guidelines for development of infrastructure network that allows bikers to move safely and efficiently from point A to point B, much like sidewalk for pedestrians or paved roads for vehicles. The Guide for Development of Bicycle Facilities by the American Association of State Highway Transportation Officials (AASHTO) provides the technical foundation for designing bike facilities. Other jurisdictions, locally and nationwide, have published *Best Practices* and *Lessons Learned* reports that provide additional support information. Also utilized in the development of the Bikeway Plan is the City's database of road characteristics, which include vehicle speed and average daily traffic volume.

The main infrastructure elements of a Bikeway infrastructure are:

3.1 Off-roadway paths or trails

Multiple-use trails accommodate several user types – pedestrians, bicyclists, skaters, etc. – and are physically separated from vehicular traffic. Off-roadway trails surround Gude Lake, for example.

3.2 Sidepaths

A sidepath is a trail that runs parallel with a street and is part of the street's right-of-way. The infrastructure can be a stand-alone bike/pedestrian path, similar to the one along the east side of Van Dusen Road, south of the Fire Station. See Figure 2. Typically 10 feet in width, as opposed to standard 4' wide pedestrian paths, these paths can accommodate pedestrians and bicyclists simultaneously. The paths are usually separated from the roadway by a median, as shown in Figure 2.

Figure 2: Photo of Side Path on Van Dusen Road.

For long stretch of uninterrupted travel, sidepaths are safer than riding in the street. However, at intersections with streets, the offset distance of the sidepath can put a bicyclist out of a turning motorist's field of vision. See Figure 3 for example.

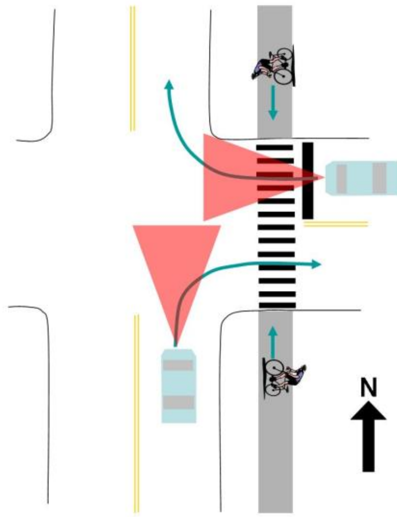


Figure 3: Illustration of potential conflicts with a turning vehicles and bicyclists on side paths.

As shown in Figure 3, a northbound motorist turning right may not see a bicyclist on their passenger side, because the bicyclist isn't in the direct field of vision. The same is true for the westbound turning driver, who is more concerned with on-coming vehicles on their left. Because of this inherent flaw at intersections, side-paths should be discouraged where possible and should be limited to long stretches of busy streets that have few side streets or driveways.

One way to mitigate the problem of using sidepaths at intersections is modify curb geometry at the intersection to have sharper turns. The sharper turns force slower right-turn movements, enabling a better chance of seeing a nearby parallel bicyclist. Another method is to install the sidepaths as close to the curb face as possible, so that bicyclists are more likely to be in drivers' field of vision. Still another method of drawing a motorist's attention is to install large high-visibility crosswalks at these intersections and incorporate signage such as the type shown in Figure 4.

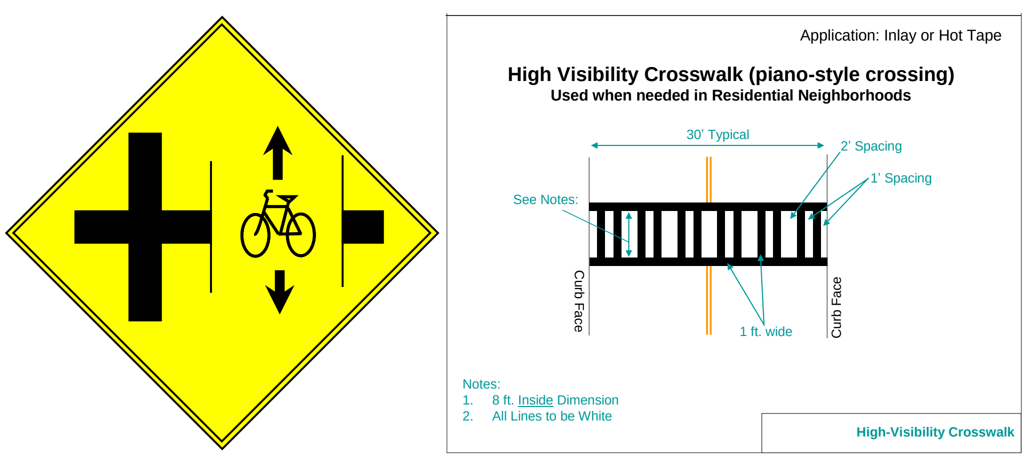


Figure 4: Sidepath Signage and Laurel-standard high-visibility crosswalk

3.3 Striped Bike Lanes

Striped in-roadway bike lanes are more common than paths, particularly in urban areas where right-of-way is limited. Bike Lanes utilize existing infrastructure (i.e. roads) in a shared manner for both cars and bikes. For roadways that are wide enough, striping-out designated Bike Lanes is a simple cost-effective method for installing designated bike-only infrastructure. A bike-only lane marking is shown in Figure 5.

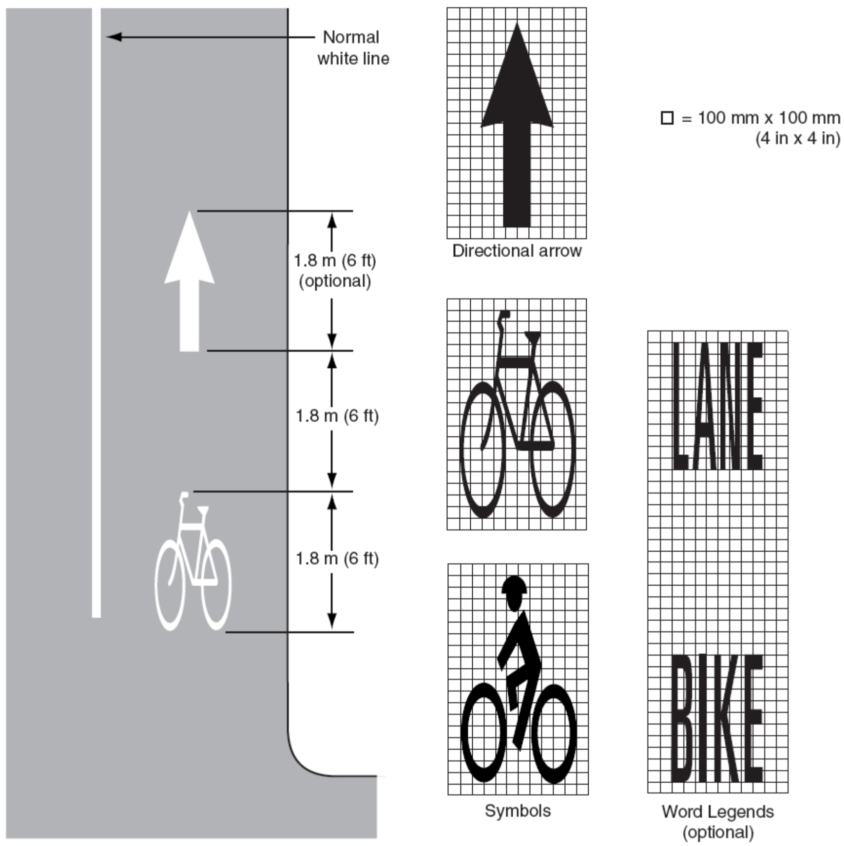


Figure 5: Standard Bike Lane pavement markings. (Source: MUTCD, Ch. 9).

Bike lanes should be a minimum of five (5) feet in width from a curb face to the solid lane divider. Because a bike lane usually encompasses a concrete gutter pan, regular street-sweeping is needed to ensure safe travel. Moving or parked vehicles are prohibited from bike lanes. Striped bike lanes provide a visual separation between vehicle traffic and bike traffic. In addition, striping an existing roadway for a bike-lane narrows the travel way for vehicles, which has a traffic-calming effect on the road segment, resulting in lower average vehicle speeds.

Striped bike lanes are feasible on travel lanes that are a minimum of 15-16 feet wide in each direction with no side-street parking. However, travelways are not always wide enough for a bike lane, because the road is simply not wide enough or because on-street parking cannot be removed. In these instances, there are other measures available for marking a roadway.

3.4. Combined Biking/Parking Lane

Many residential roadways have wide lanes that allow on-street parking, but it only gets utilized during special occasions. In order to maintain the ability to park yet still provide a safe travel lane for cyclists, this extra roadway width can be striped as a shared parking/biking lane. This can be done simply by striping a solid white line 7 to 8 feet from the edge of pavement on both sides for biking and the occasional parked car. An example of this type of striping is on Brooklyn Bridge Road, between Dorset Road and Patuxent Road, as shown in Figure 6.

Figure 6: Brooklyn Bridge Road, with shoulders striped for parking

Cyclists would use these shared lanes as they would a bike-only lane, but in the infrequent presence of parked cars they would utilize the vehicle-travel portion of the roadway. The road is signed as a Bike Route (see section 3.6), with no other bike lane signage or pavement markings. A side benefit to this striping is the appearance of a narrow vehicle travel lane, which often translates into reduced overall traffic speeds.

3.5 Signage: "Bike May Use Full Lane"

Roadside signage is also used to provide information to motorists and bicyclists about the way a roadway is designated.

Legally, bicyclists may always use full lanes on residential roads, but they are encouraged to ride on the right side of a lane. However, this sign designation is for special circumstances where the lane width is too narrow to accommodate both vehicles and bikes. This sign location is along 7th Street in Old Town Laurel, where there is on-street parking that reduces the usable travel lane width to approximately 10 feet for both vehicles and bikes.

3.6 Signage: "Bike Route" (with optional destination and direction marker)

This signage designates a travelway as a preferred road for bike users. Optionally, the sign can have a destination marker and/or directional marker, as shown. The AASHTO Guide for the Development of Bike Facilities recommends spacing of the signs at 500 meters.

3.7 "Share the Road" Signage

Many roads have a travel lane that is extra wide (but not wide enough for a striped bike lane). These roads that are designated as preferred bike routes can be signed as such and include "Share the Road" signage to reinforce the message that the signed travel-way is available to both vehicles and bikes. Two lane roads that are 30' (Laurel City Code minimum road width) and have no parking are excellent candidates.

3.8 Sharrows

"Sharrows" are shared-lane pavement markings. Where there is on-street parallel parking, sharrows help reduce crashes with doors opening on parked cars, by guiding bicyclist to the proper location away from the reach of a swinging card door. The center of the sharrow marking must be at least 11 feet from the curb face. This will provide a bicyclist who rides in the center of the sharrow enough clearance if a parked car door were to open suddenly.

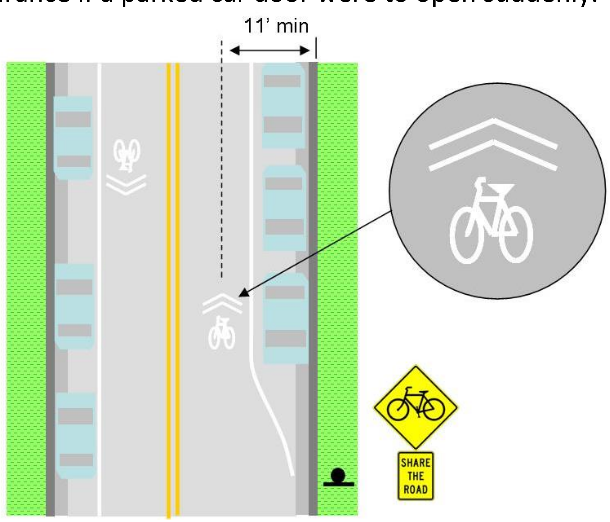
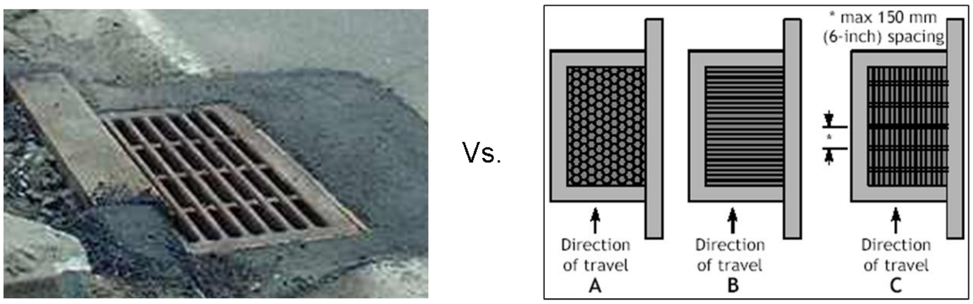


Figure 7: Sharrow Pavement Markings

4. Other Design Guidelines

4.1 Storm-water Drain Grates

Another aspect of utilizing infrastructure is the proper handing of storm-water grates. Storm-water grates are found curbside of roads, where bicycle lanes are striped. Older grates have wide grooves that can catch bike tires. Any designated bike route must avoid streets with these types of storm-water grates or replace the grate covers with newer, safer styles (see Figure 8).



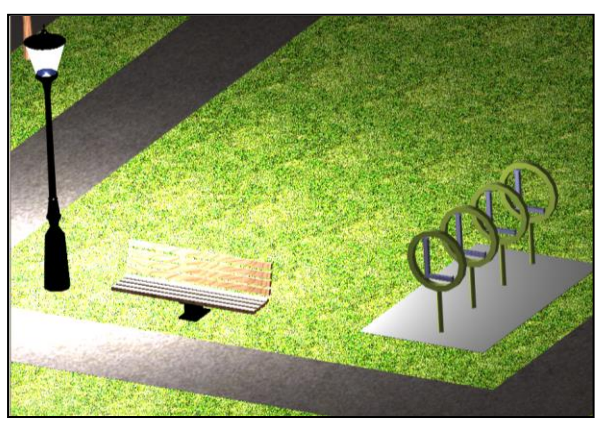
Falling Hazard Tires can't get caught in grooves

Figure 8: Example of dangerous stormwater grate and improved version

4.2 Bike Racks

A standard hoop rack shape allows for locking both wheels and/or frame to the rack. Each inverted "U" can accommodate 2 bicycles. New bike racks in City Parks will also require a concrete pad to bolt/secure them. Bike racks should be positioned in secure, visible and well-lit areas. Spacing between inverted-"U" racks should be 36" minimum.

As an alternative to standard hoop racks, the city can commission a contest for local artists to design a customized Laurel bike rack that can be installed at City Parks.



4.3 Traffic Calming

Vehicle speed plays a large role in bicyclists' level of comfort on shared- use roads and on-street dedicated bike lanes. One way to reduce vehicle speeds on roadways is through traffic calming. Traffic calming involves physical changes to the roadway in order to make speed and aggressive driving difficult or impossible. There are two types of geometric changes to a roadway to slow down vehicles – vertical changes, such as speed bumps and speed humps; and horizontal changes such as lane constrictions and traffic circles. The City of Laurel has enacted traffic calming measures on several neighborhood collector roads. The City's traffic calming program only utilizes *horizontal* traffic calming measures. Horizontal measures include:

1. Traffic circles (see Figure 10),
2. Chicanes,
3. Chokers,
4. Bulb-outs
5. Center-island medians.

An illustration of chicanes, chokers and center-island medians is shown in Figure 9. A bulb-out is similar to a choker, but is much smaller and is applied at intersections instead of at mid-block.

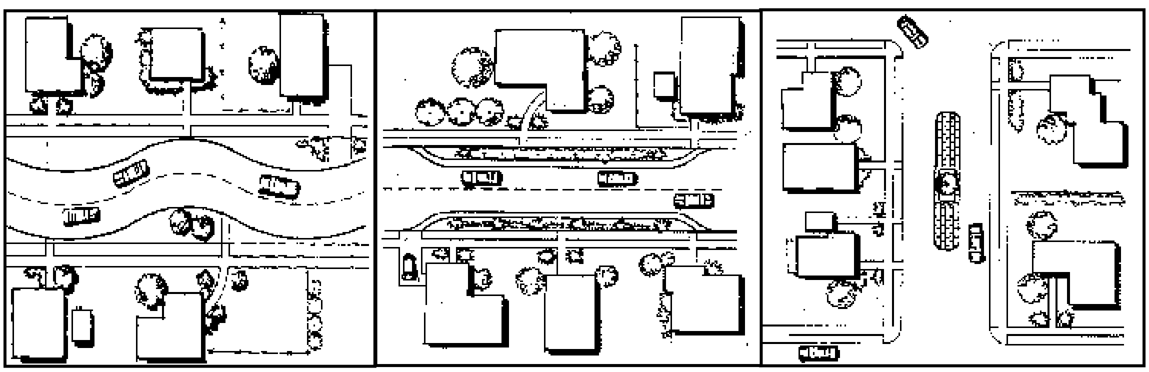


Figure 9: Schematic of Chicane, Choker, and Center-island median, respectively. (Source: Institute of Traffic Engineers)

Of these traffic calming devices, the City of Laurel has constructed, or has planned for near-term construction, all of the above-listed measures except for *chicanes*. Studies have shown that traffic calming encourages pedestrian and bicyclist travel (Clarke and Dornfeld, FHWA, 1994).

The City does not include vertical geometric changes on any of its roads and has no plans to implement any. This policy is based on the needs and abilities of the Public Works fleet. However, speed humps and speed bumps are also uncomfortable for bicyclists, as well, and will not be part of the City's traffic calming plans.

Figure 10: Traffic Circle at Intersection of Montrose Ave and Harrison Dr.

5. Roadway Segment Data and Bicycle Level of Service (BLOS)

Twenty-three (23) roads have been designated as potential Bikeways. These roads were chosen to connect neighborhoods with parks, commercial centers, and other neighborhoods in a way that maximizes BLOS and avoids traveling on State-maintained roadways that have high vehicle volumes and speeds, along with narrow lanes.

BLOS is a method of quantifying the "bike-friendliness" of a particular road. It is not a measure of congestion/capacity like vehicular level of service, but rather it endeavors to determine a cyclist's comfort level. BLOS grades roads on an A-F scale, similar to vehicle LOS, with an "A" being the safest roadway to ride on, and F being the least comfortable.
BLOS is based on 5 factors:

1. Vehicle Speeds,
2. Vehicle Volumes
3. Shoulder/Bike-Lane Width
4. Pavement Conditions
5. Percent of vehicular traffic that consists of Heavy Vehicles

The two largest factors are vehicles volumes and paved shoulder width. BLOS is a tool to determine the most desirable route connecting communities with neighboring destinations, such as park, schools, or commercial districts. It can further be used to find, quantify and prioritize deficiencies in a bikeway network. See the following table for BLOS and other roadway information – such as Average Daily Traffic (ADT) - for the designated bikeway road segments

Table 1: Bike Plan Road Segment Data

Road or Road Segment	BLOS*	Roadway Width	On-Street Parking allowed?	ADT	Shoulder Type and Width
4th Street, Cherry to Greenhill	B	52'	Both Sides	7400	None
4th Street, Greenhill to Marshall	C	30'	one side	7400	None
4th Street, Gorman to Main (One Way)	A	36'	Both Sides	2000	None
4th Street, Marshall to Gorman	C	30	Both Sides	7400	None
5th Street (One Way)	A	24'	Both Sides	2000	None
5th Street (Two Way)	B	36'	Both Sides	4000	None
8th Street	B	36'	Both Sides	4000	None
9th Street	A	24'	Both Sides	2000	None
Bowie Road from CSX bridge to MD 197	D	20'	no	7400	1-3' paved
Bowie Road from CSX bridge to US 1	D	24'	no	7400	8' gravel
Brooklyn Bridge Road	B	40	yes	4200	Paved
Cherry Lane from Contee to Van Dusen	B	24'	No	4500	None
Clubhouse Blvd	A	24'	no	2900	None
Cypress Street	A	52'	Both Sides	4000	None
Domer Ave	B	30	no	<2000	None
Dorset Road	B	36'	Both Sides	<2000	
Harrison Drive	A	44'	Both Sides	900	None
Lafayette Avenue	B	24'	No	2600	None
Laurel Place	B	36'	Both Sides	7000	None
Laurelton Drive	A	36'	Both Sides	900	
Main Street	C	40'	Both Sides	9700	None
Marshall Ave	A	36'	no	<2000	None
Mulberry Street	A	52'	Both Sides	4000	None
Sandy Spring Road	C	34' to 42'	Variable	9600	paved
Staggers Lane	A	36'	Yes	<2000	None
Van Dusen from Cherry to Alan	D	46'	No	20000	Paved, Variable Width
Van Dusen from Contee to Olive Branch	C	46'	No	18000	Paved, Variable Width
Van Dusen from Olive Branch to Cherry	A	8' path	No	18000	Paved, Variable Width
West Street	C	24'	Both Sides	<2000	None
White Way	A	36'	one side	900	None

*BLOS stands for Bicycle Level of Service - a quantitave method for measuring "bike-friendlines." BLOS grades are A through F

5.1 Calculating BLOS

See the following figure for BLOS calculation methodology

$$BLOS = 0.507 \ln(Vol_{15}/L_n) + 0.199\ SP_t(1+10.38HV)^2 + 7.066(1/PR_5)^2 - 0.005\ W_e^2 + 0.760$$

where:

Vol_{15} = volume of directional traffic in 15 minutes = $(ADT * D * K_d) / (4 * PHF)$

ADT = Average Daily Traffic on the segment

D = Directional Factor

K_d = Peak to Daily Factor

PHF = Peak Hour Factor

L_n = number of directional through lanes

SP_t = effective speed limit = $1.1199 \ln(SP_p-20) + 0.8103$, where SP_p is the posted speed limit

HV = percentage of heavy vehicles (as defined in the 1994 Highway Capacity Manual)

PR_5 = FHWA's 5-point pavement surface condition rating (5=best)

W_e = average effective width of outside through lane:

$W_e = W_v - (10' * OSPA)$ where $W_l = 0$

$W_e = W_v + W_l\ (1 - 2 * OSPA)$ where $W_l > 0$ & $W_{ps} = 0$

$W_e = W_v + W_l - 2\ (10' * OSPA)$ where $W_l > 0$, $W_{ps} > 0$, and a bike lane exists.

W_t = total width of outside lane (and shoulder) pavement

OSPA = fraction of segment with occupied on-street parking

W_l = width of paving between outside lane stripe and edge of pavement

W_{ps} = width of pavement striped for on-street parking

W_v = effective width as a function of traffic volume

$W_v = W_t$ if ADT>4000 veh/day

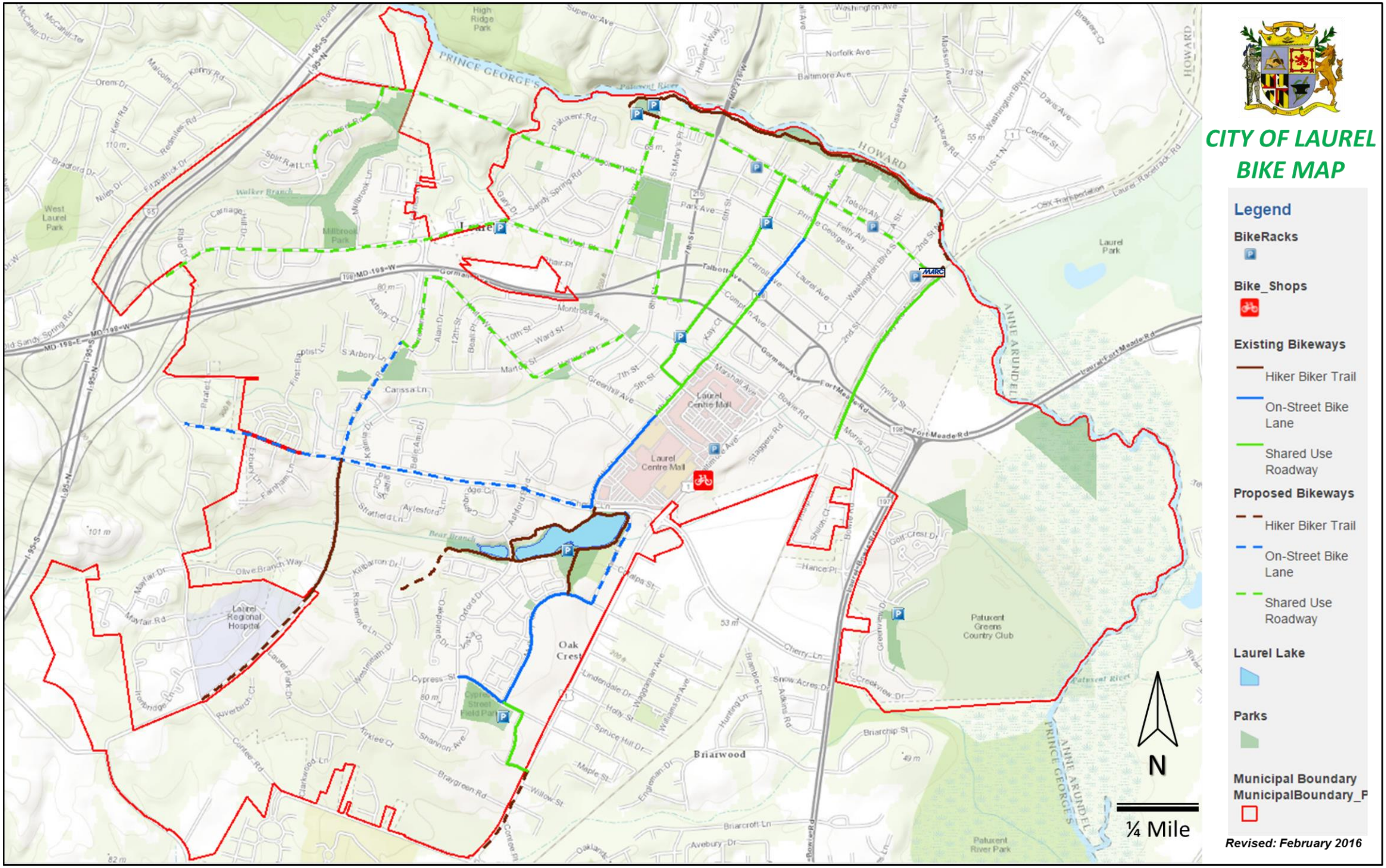
$W_v = W_t\,(2 - (ADT/4000))$ if ADT<4000 and road is undivided and unstriped.

Bicycle Level of Service ranges associated with level of service (LOS) designations:

BLOS Score Range	≤ 1.50	1.51-2.50	2.51-3.50	3.51-4.50	4.51-5.50	> 5.50
LOS Level or Grade	A	B	C	D	E	F

6. Laurel Bike Map

The following page shows the map of the existing and proposed City of Laurel Bikeways. This map illustrates which roadways are designated as Bikeways and the types of the proposed bikeway. The map is based on the locations of neighborhoods, parks, retail/commercial cores in conjunction with City BLOS data. Only roads that are under the jurisdiction of the City of Laurel can be modified by the City. The City has no jurisdiction over County Roads – such as Contee Road, Brooklyn Bridge Road or State Roads - such as US 1 or MD 198.


CITY OF LAUREL
BIKE MAP
Legend
BikeRacks
Bike_Shops
Existing Bikeways
Hiker Biker Trail
On-Street Bike Lane
Shared Use Roadway
Proposed Bikeways
Hiker Biker Trail
On-Street Bike Lane
Shared Use Roadway
Laurel Lake
Parks
Municipal Boundary
MunicipalBoundary_P
Revised: February 2016
N
¼ Mile

7. Proposed Laurel Roads as Bikeways

The following is a brief description of each road segment along with an illustration showing how each roadway segment would be signed/re-striped.

4th Street, from Cherry to Greenhill *– Implemented 2011*

4th Street runs north-south and connects Riverfront Trail, Old Town and Main Street, Towne Centre at Laurel, and Gude Lake Park. 4th Street, from Cherry Lane to Greenhill Ave, is 52 feet wide with on-street parking on the Mall side. Vehicle volume is moderate at over 7,000 vehicles per day. There is available width to include a 14 foot travel way in each direction for cars, a 6 foot bike lane in each direction and a tree-lined center median for streetscaping and traffic calming purposes. 4th street should be signed with destination signage indicating that this bike route leads to Laurel's riverfront trail. See Figure below.

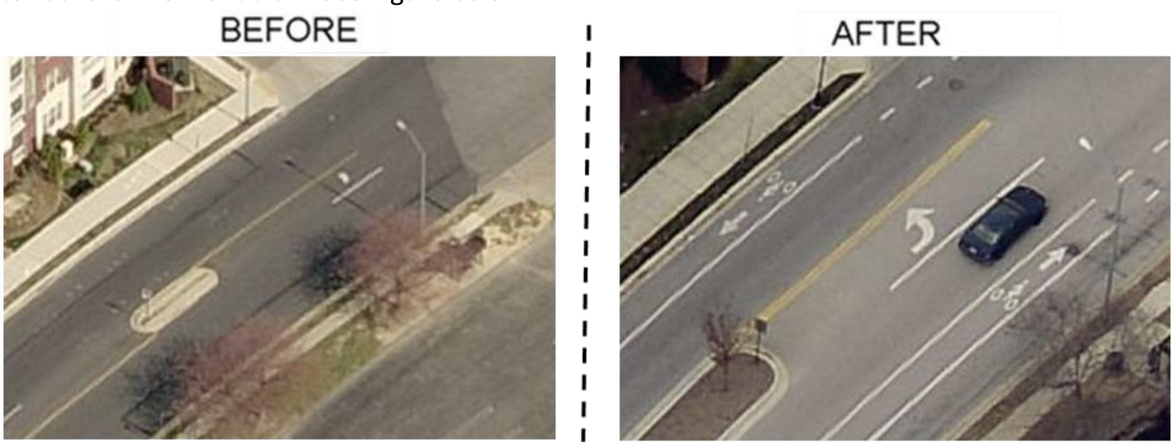


Figure 11: Before and After Signage/Striping Improvements for 4th St.

Direct path Connection from Gude Lake Park to 4th Street *– Implemented 2010*

4th Street is the main local route connecting many neighborhoods to the center of the City and to Gude Lake Park. However, the City lacks a direct off-street connection from 4th Street to the lake and park pathways. The City plans to install this direct connection from the intersection of 4th Street and Cherry Lane down to the existing Lake Path. This new connection will be wide enough to accommodate bikes and pedestrians and will link up with bike lanes on 4th Street.

Figure 12: Illustration showing direct connection to Gude Lake from the intersection of 4th/Cherry.

4th Street, from Greenhill to Marshall – ***Implemented 2010***

4th Street, from Greenhill to Marshall is 30’ wide with on-street parking on one side. This parking is used heavily at all times of the day. Vehicle volume is moderate at about 7,000. There is no room for striping a dedicated bike lane, however, this stretch of 4th Street can be signed for a bike route with accompanying destination signage for riverfront trail.

Figure 13: Before and After Signage/Striping Improvements for 4th St.

4th Street, from Marshall to Gorman – ***Implemented 2010***

4th Street, from Marshall to Gorman, is a 30’ wide travelway – 15 feet for each travel direction. There is on-street parking available, but it is recessed from the main travelway. Vehicles and bikes can share the travelway, with sharrows used to guide bicyclists to the safest riding position in order to avoid opening of parked car doors.

Figure 14: Before and After Signage/Striping Improvements for 4th St.

4th Street, from Gorman to Main (One Way) *– Implemented 2010*

4th Street from Gorman to Main is one-way northbound and has varying width. It has very low vehicle volume and sufficient space for vehicle and bikes to share the roadway, even when on-street parking is utilized. 4th street can be signed with "Share the Road" signage and marked with sharrows to indicate a safe bicycling location.

Figure 15: Before and After Signage/Striping Improvements for 4th St.

5th Street from Main Street to Gorman Road (One-Way) *– Implemented 2011*

This portion of 5th Street is a narrow one-way residential street with parking on both sides (5th street is 24' wide from Main to Talbot and 28' wide from Talbot to Gorman). The street has no shoulders, but on-street parking, while available, is sparsely used. This provides ample room for vehicles and bicyclists to share the travel width. Also, the vehicle volume is very low, which makes this a comfortable southbound route for bicycling.

Figure 16: Before and After Signage/Striping Improvements for 5th St.

5th Street from Gorman Road to Montrose Ave (Two-Way) – ***Implemented 2011***

This segment of 5th Street is a long City block with two-way travel. The road width is 36 feet, with parking on both sides and no additional shoulders. The vehicle volume is higher than the one-way portion of 5th Street, but not appreciably. On-street parking is sparse on the north side of Crab Branch, but south of the tributary, on-street parking approaches 100% utilization. The low vehicle volumes and wide streets make this a suitable roadway for biking.

Figure 17: Before and After Signage/Striping Improvements for 5th St.

8th Street

8th street is 36 feet wide with low vehicle volume. On-street parking is allowed on both sides. 8th street destinations include McCullough Park, Emancipation Park (with access to Laurel Library), as well as Pallotti High School and St. Mary's of the Mills Elementary School. 8th Street also connects Old Town to the Laurel Hills and Fairlawn neighborhoods. 8th Street can be signed as a bike route, with sharrows marked on the roadway to indicate a safe bicycling position away from parked cars.

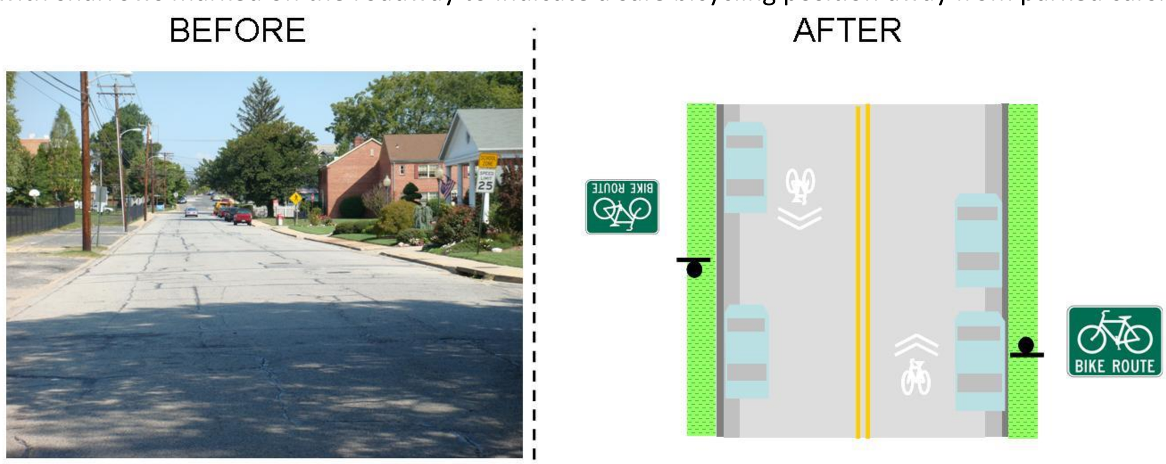


Figure 18: Before and After Signage/Striping Improvements for 8th St.

9th Street

9th Street is 24 feet wide with very low vehicle volume. Parking is limited to one side and is used moderately. Because of the ample available roadway and low number of vehicles, 9th Street is a suitable north/south route that connects West Street to Riverfront Park and to McCullough Park. 9th Street is un-striped and should remain so, with only signage indicating that it is a designated bike route.

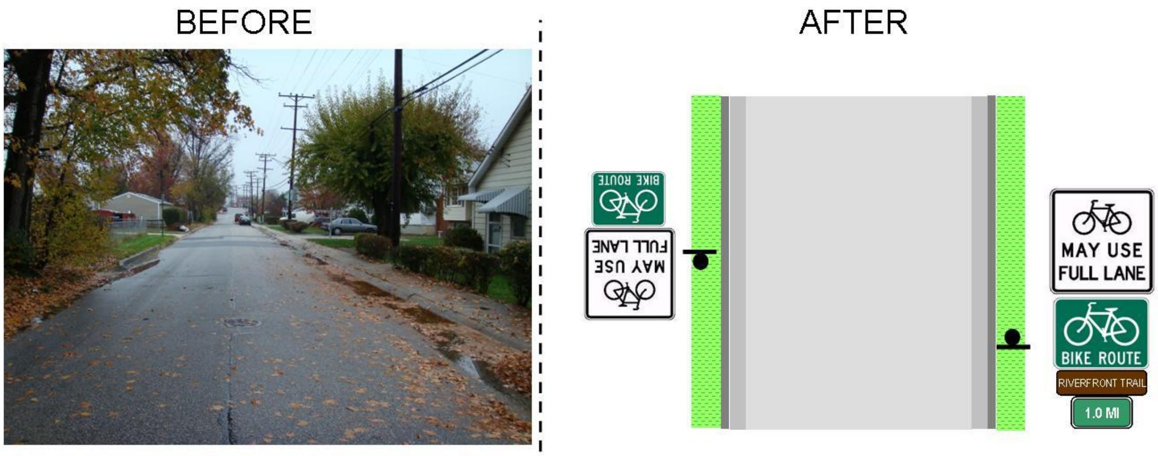


Figure 19: Before and After Signage/Striping Improvements for 9th St.

Wellington Trail

The large neighborhoods of the Wellington development do not have direct access to the City's most popular park, despite being adjacent to it. The proposed Wellington Trail would provide a direct walkable/bikable connection from the Wellington Development to Granville Gude Park and Lake and "Restaurant Row" on Laurel Place. For many Wellington residents, utilizing the trail would provide quicker access to these amenities than driving/parking at the Lake. This also has the added benefit of reducing traffic congestion on local roads.

Figure 20: Illustration of asphalt sidewalk location to connect Wellington to Gude Lake.

Bowie Road from Route 1 to the CRX bridge underpass

This stretch of Bowie Road sees substantial pedestrian traffic throughout the day. The current road conditions are such that there is available room for separate and striped hiker/biker lanes where currently only gravel shoulders exist. It is recommended that these shoulders be paved and striped for pedestrians/bikers.

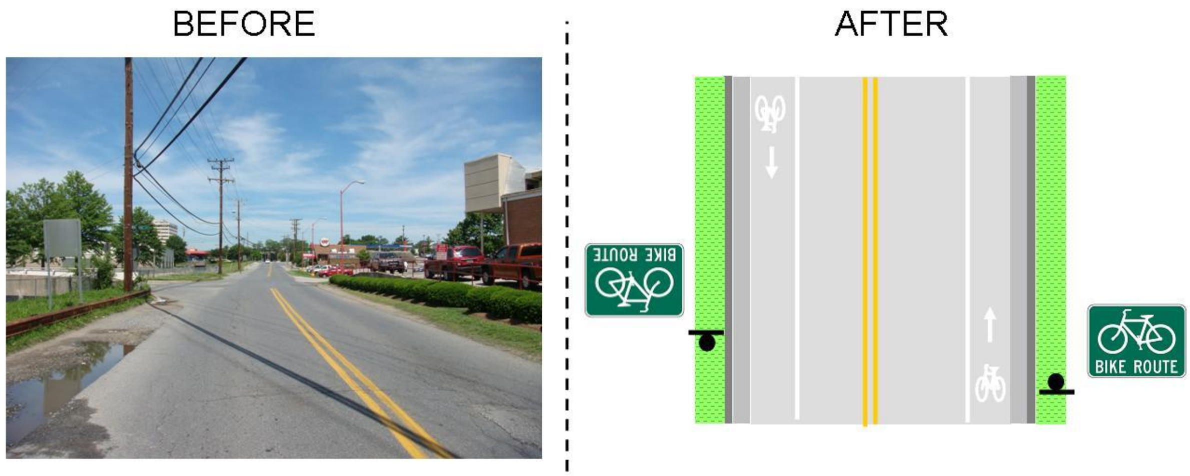


Figure 21: Before and After Signage/Striping Improvements for Bowie Rd.

Bowie Road from MD 197 to the CRX bridge underpass

Bowie Road is a narrow roadway with moderate volume. It has narrow paved shoulders that vary in width from 1 to 3 feet. While, not an ideal bike route, Bowie Road is the only direct connection between the Route 1 Corridor and Patuxent Greens neighborhood, as well as the Greenview Drive City Pool and the Business Park. Future redevelopment, if any, along Bowie Road should incorporate wider sidewalks (at least 8 feet) on both sides of Bowie Road to accommodate pedestrians and bicyclists. This segment of Bowie Road is currently under the jurisdiction of Prince Georges County, but may be turned over to the City in the future.

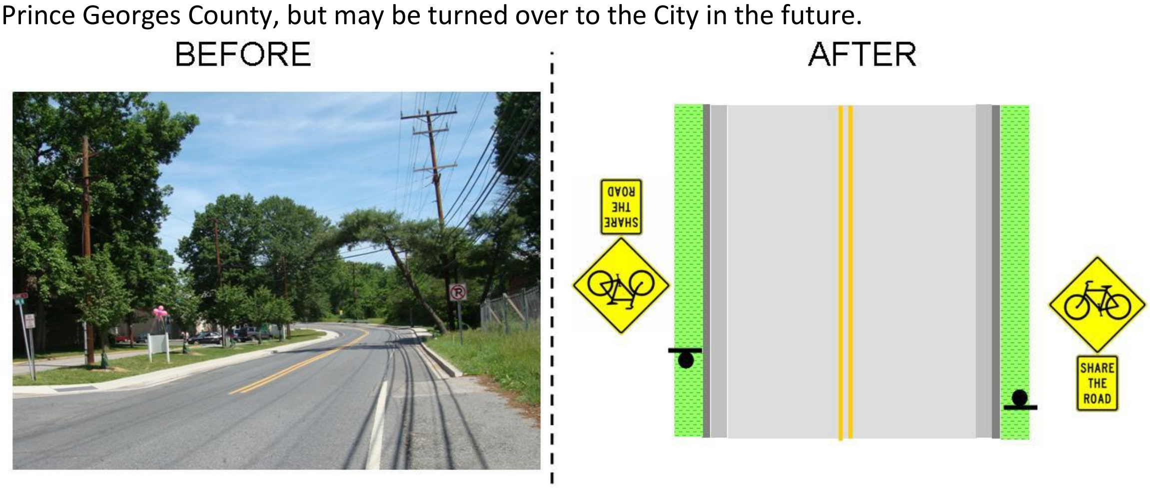


Figure 22: Before and After Signage/Striping Improvements for Bowie Rd.

Cherry Lane from Contee to Van Dusen

This segment of Bowie Road is a narrow 2-lane roadway, with a rural character. There are no curbs, gutters or shoulders. It currently serves only a handful of large-lot single-family properties and the vehicle volume is extremely low. Medium-density development has been proposed to access this roadway, which will overwhelm the roadway capacity. This proposed development, if accepted, presents an ideal opportunity to widen the roadway to allow for bike/pedestrian travel along the entire stretch of Cherry Lane from Contee to Van Dusen. The road is currently under the jurisdiction of Prince Georges County, although many properties that abut it are inside the jurisdictional boundaries of the City of Laurel.

Figure 23: Before and After Signage/Striping Improvements for Cherry Lane.

Option for Re-designing Cherry Lane from Van Dusen to 4th Street

Cherry Lane from Van Dusen to 4th Street would be a critical component in Laurel's Bikeway Plan, because it connects the two main north/south routes - 4th Street and Van Dusen Road. While Cherry Lane is an attractive tree-lined road with sidewalks on both sides, for it to reach its true potential as an ideal urban boulevard that leads to a City Center, all traditional transportation modes – driving, walking, and biking – should be accommodated. Fortunately, Cherry Lane has ample right of way and is vastly over-designed for vehicle traffic. Cherry Lane has 6 lanes of traffic to accommodate an average daily traffic of about 20,000. As a point of reference, MD 198 on the west side of Van Dusen carries twice that volume on only 4 travel lanes. It is unlikely, that even with future development that Cherry Lane will exceed 30,000 vehicles. Therefore, the outer lane on each side of Cherry Lane can be re-designated, at minimal cost, as a bike-only lane. This will result in negligible changes in level of service to vehicles.

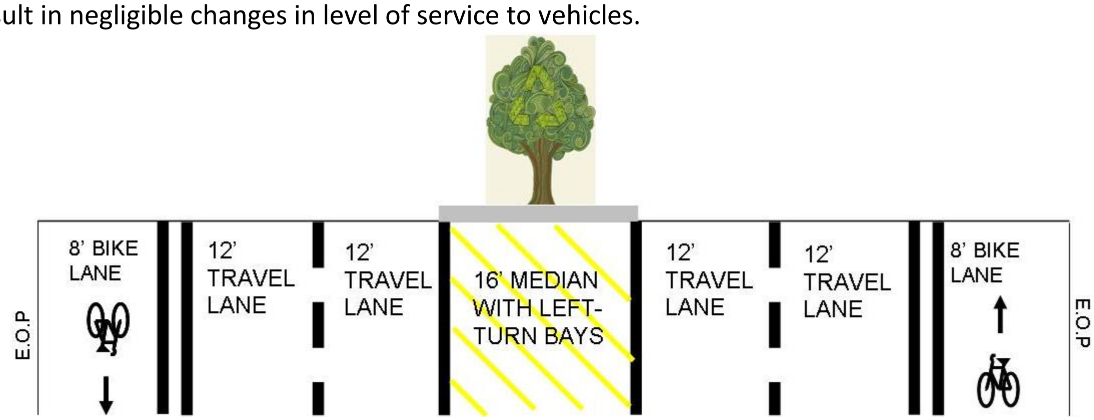


Figure 24: Re-striping Cherry Lane from 6 travel lanes to 4 travel lanes and 2 bike lanes.

Clubhouse Blvd

Despite being striped for two inbound and two outbound lanes, Clubhouse Boulevard is a very low-volume collector road for the Patuxent Greens neighborhood. Clubhouse Boulevard also serves a City Pool and recreational facilities. Because Clubhouse Blvd has excess capacity, it can be re-striped to convert an existing travel lane in to a bike lane. One lane in each direction can be converted to a bike-only lane with no measurable loss in vehicle level of service.

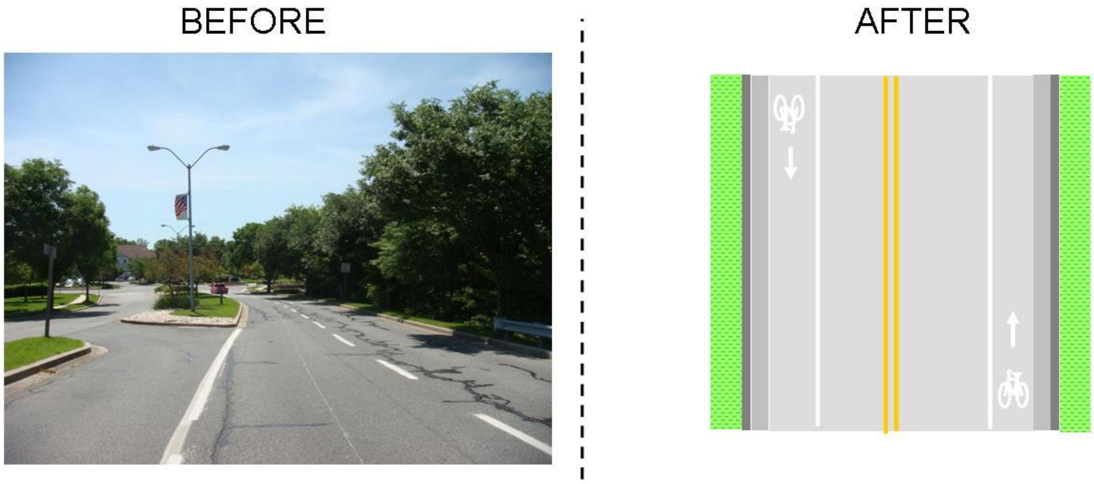


Figure 25: Before and After Signage/Striping Improvements for Clubhouse Blvd.

Cypress Street *– Implemented 2011*

Cypress Street from Oxford Drive to Mulberry Street is 52 feet wide and allows parking on both sides, though on-street parking is rarely utilized. Cypress can be striped to keep on-street parking (8-ft "lanes" on each side) and still include 6 ft-wide bike lanes with 12 ft-wide travelways for vehicles.

Figure 26: Striping Cypress St. for dedicated Bike Lanes

Domer Ave

Domer Ave, on the north side of Laurel Commons, is an important component of the Bikeway Transportation Plan, because it provides a low-volume east-west connection for joining existing communities on the west side of the Mall with future planned communities on the east side of Route 1. In its current state, Domer Ave resembles a large alley more than it does a legal street. However, its low vehicle volume and prohibition of on-street parking make it a logical choice for connecting the east side of Laurel with the west side.

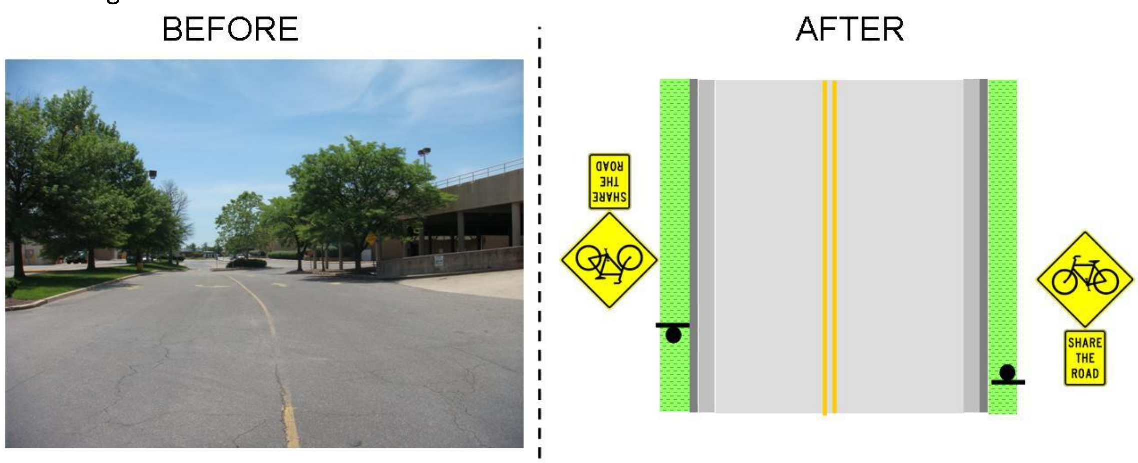


Figure 27: Before and After Signage/Striping Improvements for Domer Ave.

Dorset Road

Dorset Road runs north/south connecting two other local collector roads – Brooklyn Bridge Road and Sandy Spring Road. Most of Dorset Road is 36 feet wide with parking on both sides. Parking is utilized at approximately 25% to 50%, depending on the block. A small portion of Dorset, from Woodbine Drive to the Brookmill Condominiums is only 24 feet wide with no parking permitted. The low volume on the road and wide travel widths make Dorset a suitable north/south bikeway. Scotchtown Elementary School is also located on Dorset Road. Dorset Road can be striped for parking lanes and marked with sharrows in the travelway for guiding bicyclists.

Figure 28: Before and After Signage/Striping Improvements for Dorset Rd.

Brooklyn Bridge Road

Brooklyn Bridge Road is a low-volume east-west collector connecting the City of Laurel to points West. Most residents that live along Brooklyn Bridge are inside the Jurisdiction of the City of Laurel, however, Brooklyn Bridge Road itself is under the jurisdiction of Prince Georges County. Brooklyn Bridge is 40 feet wide and is currently striped for an 8' parking/shoulder lane on both sides. This lane is an ideal candidate for a shared parking/biking lane, as on-street parking is utilized sparsely. Brooklyn Bridge road needs only to be signed for Bike Route designation.

Figure 29: Before and After Signage/Striping Improvements for Brooklyn Bridge Rd.

Brooklyn Bridge Road becomes Montgomery Street as it enters the City of Laurel and crosses over a tributary that feeds the Patuxent River. At this location Brooklyn Bridge narrows to approximately 30 feet across (see photo below), which is the width for the remainder of Montgomery Street until its termination at Route 1.

Figure 30: Transition from wide paved shoulder to narrow shoulder on Brooklyn Bridge Road.

Additional signage is recommended for this to warn motorists and bicyclists that this road segment narrows and that both vehicle types must share the road.

Harrison Drive

Harrison Drive is part of the 3-street travelway, consisting of Laurelton Drive, White Way, and Harrison Drive that allows for east-west travel from Van Dusen Road, through to both 8th and 4th Streets, without having to utilize MD 198. Harrison Drive allows parking on both sides, but is wide and has very low vehicular volume, making it an ideal candidate for biking. Harrison Drive is also the location of the popular and newly-renovated Discovery Park.

Figure 31: Before and After Signage/Striping Improvements for Harrison Dr.

Lafayette Avenue ***– Implemented 2013***

Lafayette Ave is a narrow north-south collector road that connects Bowie Road to the Laurel MARC Station. On-street parking is prohibited and the vehicle volumes are very low. Lafayette can be left un-striped and can be signed for bicycle routes, with the added caveat the bikes are allowed full occupancy of the travel way. Leaving the road un-striped allows for motorists to safely pass bicyclists if a safe opportunity to do so exists.

Figure 32: Before and After Signage/Striping Improvements for Lafayette Ave.

Laurel Place

Laurel Place is 36 feet wide. Parking on Laurel Place is never utilized, with the exception of the 4th of July Celebration, where vehicle restrictions are put in place. Because Laurel Place is wide and leads to both Gude Lake Park and Laurel Commons, it is an ideal candidate for striping of 6' bike lanes on both sides.

Figure 33: Before and After Signage/Striping Improvements for Laurel Place

Laurelton Drive

Laurelton Drive is part of the 3-street travelway, consisting of Laurelton Drive, White Way, and Laurelton Drive that allows for east-west travel from Van Dusen Road, through to both 8th and 4th Streets, without having to utilize MD 198. Laurelton Drive allows parking on both sides, but is wide and has very low vehicular volume, making it an ideal candidate for biking.

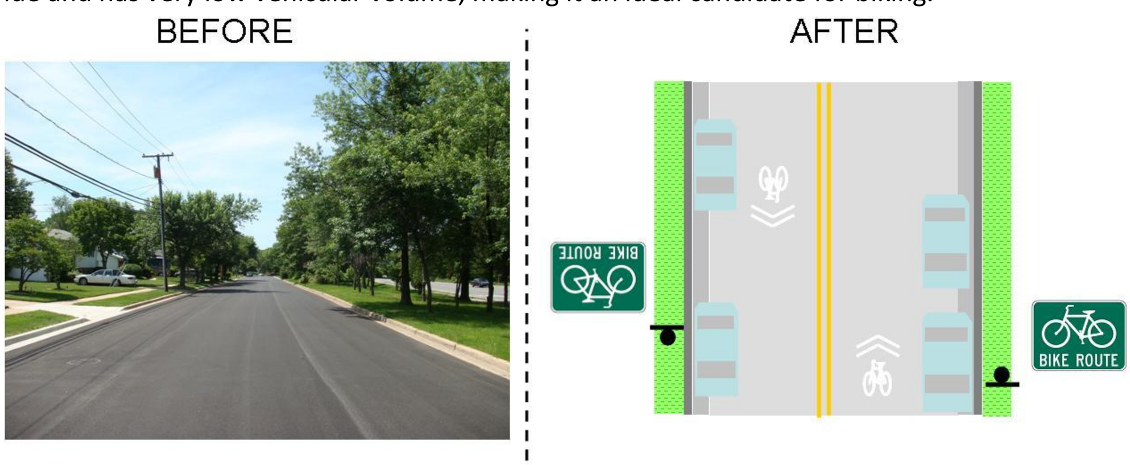


Figure 34: Before and After Signage/Striping Improvements for Laurelton Dr.

Main Street

Main Street is 40 feet wide with on-street parking on both sides that is usually near capacity. The on-street parking reduces the travel way to about 14 feet in each direction. Main Street has a low average speed, mainly due to the on-street parking and the many pedestrian crossing locations. Since Main Street is a destination, bike access is essential. The low average vehicle speed allows for bicyclists to ride in the middle of the travel way.

Figure 35: Before and After Signage/Striping Improvements for Main St.

Marshall Ave

Marshall Ave abuts the proposed Hawthorne Place mixed-use development. It is expected that this development will be both a destination and an origin for many bicyclists. Marshall Ave is wide enough to accommodate a 12 feet travel way and 6 feet striped bike lane in each direction. Alternatively, since the development is a "blank slate" at this point, on-street parking can be maintained while building extra-wide sidewalks to accommodate pedestrians and bicyclists. Biking accommodations must be incorporated into the Developer's off-site improvements for Marshall Ave.

Figure 36: Before and After Signage/Striping Improvements for Marshall Ave.

Mulberry Street – *Implemented 2013*

Mulberry Street from Cypress to Laurel Place is 52 feet wide and allows parking on both sides, though on-street parking is sparse. Mulberry can be striped to keep parking and still include 6 feet wide bike lanes with 12 feet wide travelways for vehicles.

Figure 37: Striping Mulberry Street for dedicated Bike Lanes.

Sandy Spring Road

Sandy Spring Road is a variable-width road with moderate volume of just under 10,000 per day. It connects City Hall with several neighborhoods to the west and to Old Town to the east. Where Sandy Spring is wide enough, on-street parking is allowed, however, its use is rare. Roadways with these characteristics are ideal for striping of a dual parking/biking lane. The road will be signed for biking but no bike-specific road markings will be utilized – only a solid white line to separate the travelway with the dual purpose lane.

Currently, the portion of Sandy Spring Road from Montgomery Street to City Hall is owned and maintained by the City of Laurel, while the rest is owned and maintained by Prince Georges County. Any striping and signage changes installed on this roadway should be coordinated between the two jurisdictions.

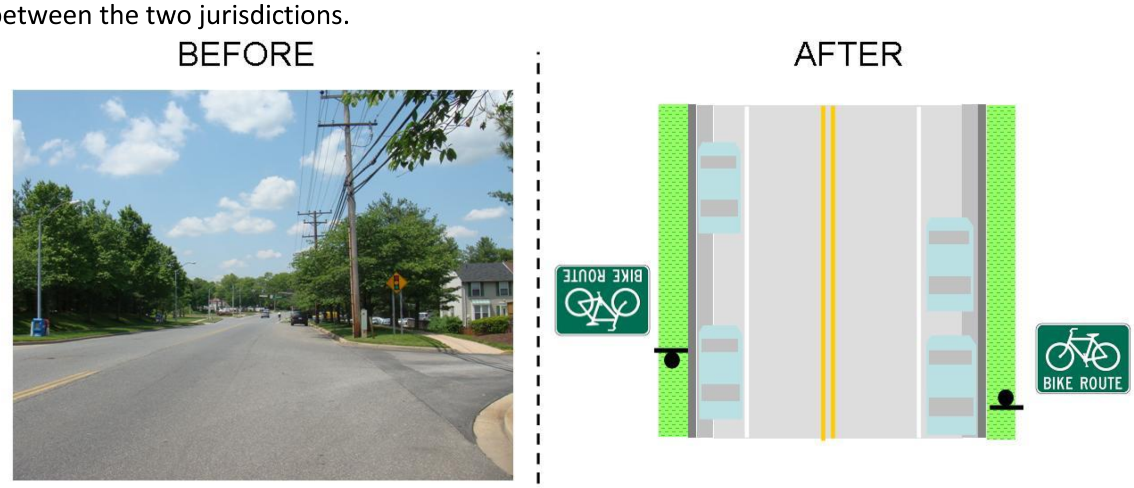


Figure 38: Before and After Signage/Striping Improvements for Sandy Spring Rd.

Staggers Lane

Staggers Lane is 36 feet wide and has on-street parking on both sides. Staggers Lane will front the new Hawthorne Place development, consisting of high-density residential and ground-level retail. Therefore, on-street parking must be kept. The development is expected to bring bicyclists that utilize Staggers Road to reach Laurel Commons, Gude Lake Park, and the Giant grocery store across from Route 1. As a result, on-street bicycling is important, but can be accommodated safely due to the low vehicle volume anticipated for Staggers Lane. Biking accommodations must be incorporated into the Developer's off-site improvements for Staggers Lane

Figure 39: Before and After Signage/Striping Improvements for Staggers Lane

Van Dusen from Cherry Lane to Allen Drive

Van Dusen Road has about 22,000 vehicles per day, often with speeds in excess of 35 mph. Therefore, it is not a desired bike route, but the roadway can be made it easier for bicyclists. Van Dusen has a narrow asphalt shoulder on both sides and 12 foot travel/turn lanes. The entire paved road width is 46 feet, which includes wide northbound and southbound lanes, two-way turn lanes and narrow paved shoulders of variable width. Re-striping of the roadway will allow for 6 foot striped bike lanes on both sides of the street and 12 foot travel lanes and a 10 foot two-way left turn lane, all without compromising vehicle capacity. In addition, re-striping of Van Dusen would contribute to traffic calming on the roadway. Van Dusen has a steep drop-off on the east side that is protected with guard rail. This drop-off makes any widening of Van Dusen expensive.

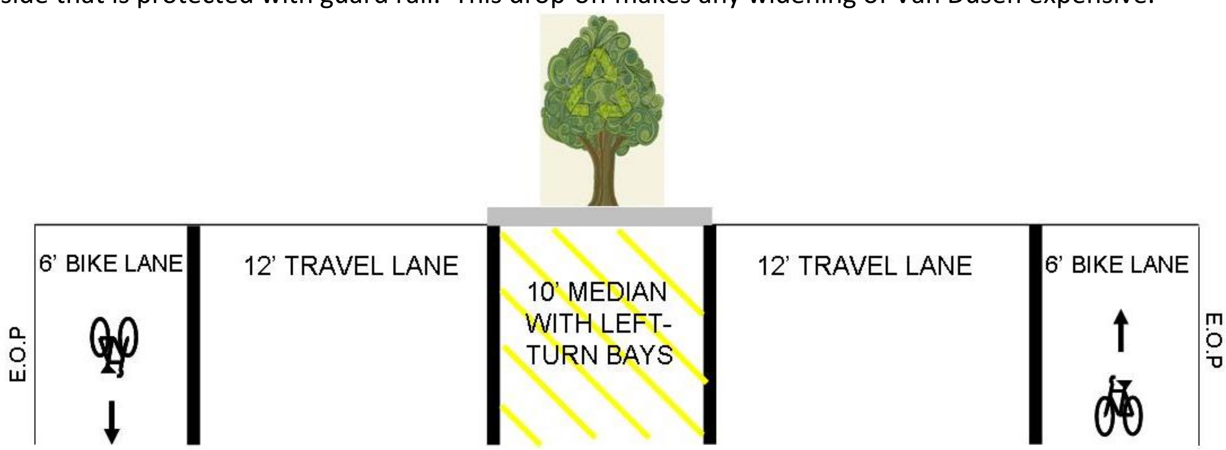


Figure 40: Re-striping Van Dusen to accommodate bicycling and incorporate traffic calming.

Van Dusen from Olive Branch Road to Cherry Lane

Van Dusen from Olive Branch Road to Cherry Lane has a 10 foot asphalt sidewalk that doubles as a hiker/biker path. This path gets regular recreational usage from walkers and joggers as well as from students walking to and from Laurel High School.

Figure 41: Existing 10 ft hiker/biker trail along Van Dusen, looking north toward Cherry Lane.

Van Dusen from Contee Road to Olive Branch Road

The above asphalt sidewalk extends southward about 50 yards south of Olive Branch/Killbarron Drive prior to terminating abruptly, as shown in Figure 42. Extending this path southward, past the Hospital and down to Contee Road would benefit Laurel Citizens. This hiker/biker path will allow easy biking connection to the planned mini-city, Konterra, which itself is planned to be bike-friendly. Ample right of way of exists for this improvement. Figure 43 shows the proposed trail extending southward (shown as a dotted brown line) along Van Dusen Road that travels past existing office and retail and Laurel Hospital on its way toward Konterra.

Figure 42: Termination of Van Dusen Sidepath, just south of Killbarron Drive.

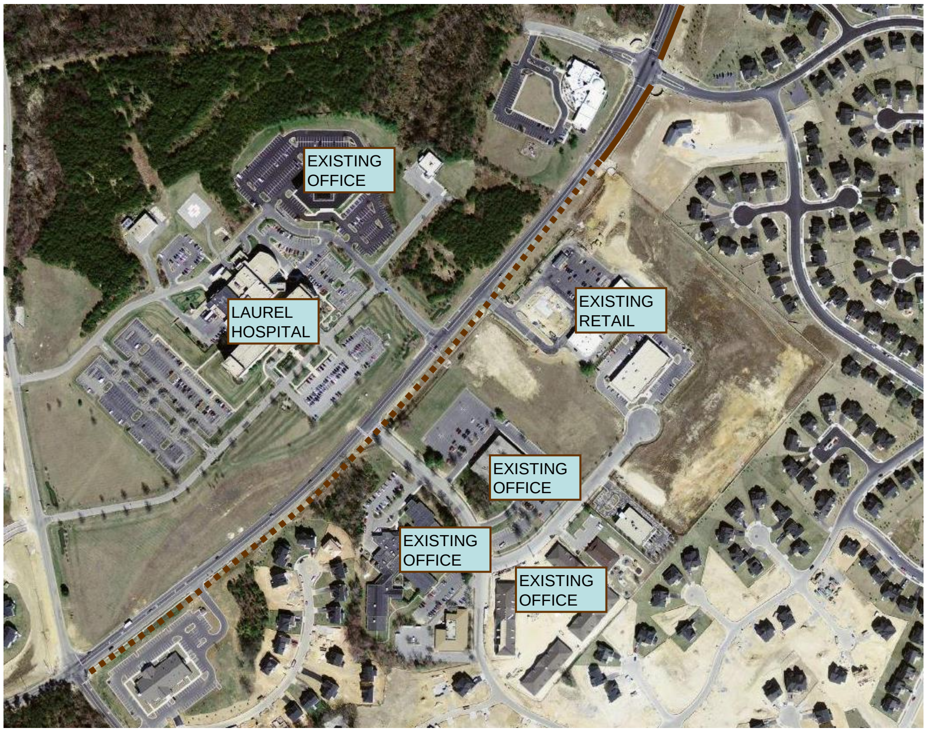


Figure 43: Extension of Pedestrian side trail – shown as a dotted brown line - along Van Dusen from Killbarron Road in the north to Contee Road in the South.

West Street

West Street links City Hall and neighborhoods west to 8th Street and 9th Street, and over to Riverfront Trail. West Street is 24' feet wide, but has a very low vehicle volume and sparse on-street parking. These characteristics make it an ideal candidate for biking east/west in Laurel.

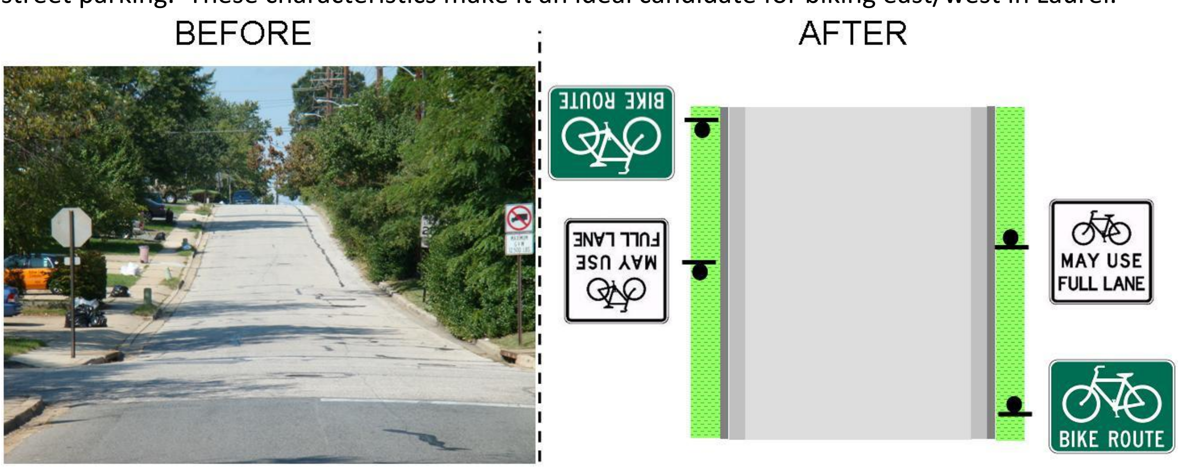


Figure 44: Before and After Signage/Striping Improvements for West St.

White Way

White Way is part of the 3-street travelway, consisting of Laurelton, White, and Harrison that allows for east-west travel from Van Dusen Road, through to 8th and 4th streets, without utilizing MD 198. White Way allows parking on both sides, but is wide and has very low vehicular volume, making it an ideal candidate for biking.

Figure 45: Before and After Signage/Striping Improvements for White Way.

Route 1 Corridor

The right-of-way (including sidewalk) for the Route 1 Corridor is under the jurisdiction of Maryland State Highway Administration (MD SHA). However, Route 1 provides the most direct link between the City residents and retail/restaurants on Contee Road to the hotels off Braygreen Road and the large commercial retail area from Cypress north to Cherry Lane. Except for a small gap in sidewalk (see Figure 46), there is currently a 4 ft sidewalk along the entire length of the west side of Route 1 – which is in the City limits. The east side of Route 1 is under the jurisdiction of Prince Georges County and has virtually no sidewalk. It should be the goal of the three jurisdictions to see that Biking is accommodated along Route 1 in some manner.

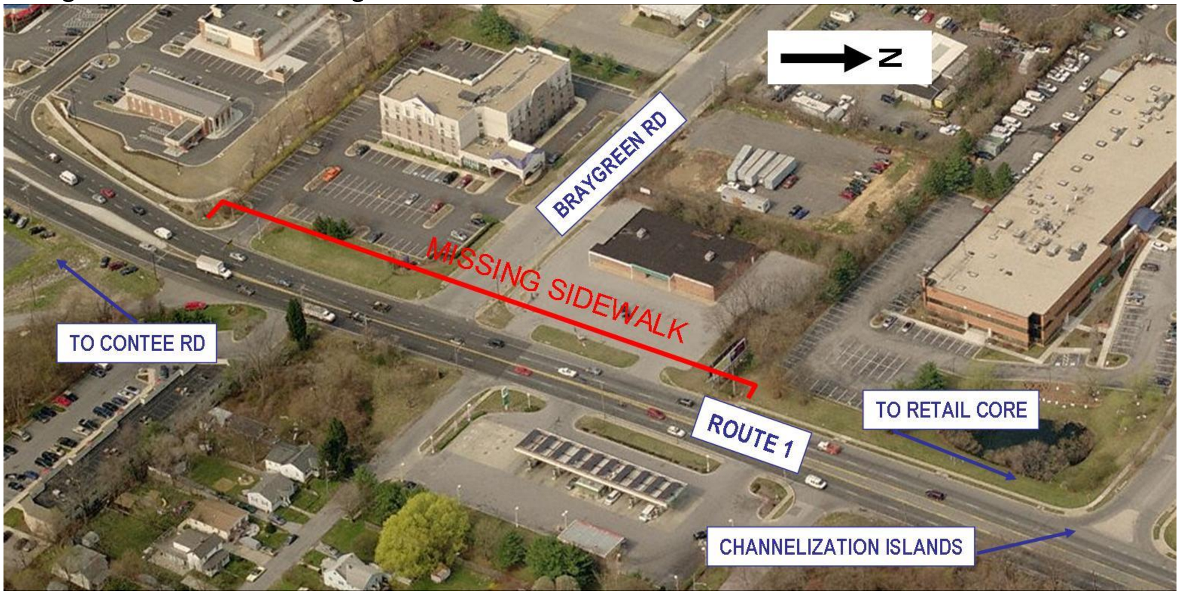


Figure 46: Route 1 near Braygreen Road.

This section of Route 1 between Contee Road and Cypress Street has commercial offices, retail, restaurants (sit-down and fast food) and shopping, yet is under-served from a pedestrian/bike infrastructure perspective. Currently, the travel lanes on Route 1 are too narrow for bikes to safely share the roadway with vehicles. Similarly, the sidewalks are too narrow for bikes and pedestrians. However, there is available right-way to increase the sidewalk width and replace it with a 10-ft asphalt shared-use path. This would provide the most direct route to join residents with many retail offerings, restaurants and grocery shopping.

Even with a median-separated shared-use lane, another large-scale design changes needs to take place at the driveways along the entire corridor. As shown in the lower right-hand corner of Figure 46, the corridor has many channelized right-turn islands that are designed to allow fast vehicle ingress/egress from Route 1. These right-turn islands and large-radii curves are extremely dangerous to bicyclists and pedestrians, because fast entering/exiting motorist do not have time to see them and often don't look for them. To alleviate this, all pedestrian/bike path building should be coordinated with sharper (and slower) turn movements at all ingress/egress points.

8. Implementation, Level of Effort and Cost

Implementation costs can be broken down into two sub-costs: up-front infrastructure and continuing maintenance. Up-front capital costs include added signage and striping to existing right-of-ways as well as the cost for new bike paths constructed in City right of way. Maintenance costs include street-sweeping of bike lanes, which the City regularly performs in-house already. Maintenance costs would also include ensuring that all damaged signs and markings are repaired, and paths are cleared.

Another facet to implementing a bike network into existing city streets is user education. Educating and informing vehicle users (both bicyclists and motorists) about the meaning of road signage and proper. Fortunately, this does not have to be a capital-intensive effort, as the City has many low-cost media outlets at its disposal: City website, City Blog, and public hearings along with two local weekly newspapers: the Gazette and the Laurel Leader. A finalized and city-approved Bike Map can be made available at City Hall, community centers and local area bike shops.

Capital costs associated with implementing physical elements of a bike plan are detailed herein:

<u>New Bike Racks:</u>
The cost for a standard inverted U-shaped rack is $100. The cost for a 6'x8' concrete pad that can accommodate and secure 4 bike racks is about $250. Therefore for a new installation of 4 bike racks at a City Park, the cost will be approximately $650.

<u>Signage</u>
Breakaway signs poles and street signage are about $40 and $35 per unit, respectively. Signs should be place about every 1/3 mile and at each intersection of two main collector roads, as well as the entry to an off-road bike path.

<u>Street Markings</u>
The cost for painting lines and bike symbols is very low - about $0.25 per linear foot.

Asphalt Paths
Asphalt Path cost between $30 and $50 per linear foot.

Because of the limited right-of-way for new construction of separated bike paths, there is a lot of "low-hanging fruit" to be plucked in inexpensive re-striping/re-signing of existing roadways. The signing/re-striping can go a long way in the development of a complete City-wide Bike Transportation System.

The Bike Transportation Plan should be a part of the City's Capital Improvement Plan (CIP), which dedicates funding for construction and maintenance - much like sidewalk repair and street re-surfacing. In addition, State grants are available for *Open Space* and for *Safe Routes to Schools*. Further, Federal DOE grants are available for alternative transportation policies that reduce energy demand. These monies are potential sources for funding bikeway-related improvements to existing infrastructure.

9. Bike-related Policy Changes

Whenever underutilized areas of the City are revitalized or redeveloped, part of the Adequate Public Facilities requirement should be the addition/improvement of bike facilities – both on-site and off-site. The City of Laurel is currently near full-development within its jurisdictional boundaries. Almost all future development will be in-fill and *re*-development. Future development, regardless of its nature, must take into account bicyclists if the City is to have a comprehensive transportation plan for all travel modes. Incorporating hiker/biker paths and on-street bicycling markings is important to this policy and integral to making sure that neighborhoods are interconnected in a macroscopic grid network. Further, having a biking infrastructure in place allows developers to make use of this alternative transportation, thus reducing the vehicular traffic mitigation needs. Just like transit-oriented development reduces vehicle trips to allow for higher-density, so too can incorporating bikeway infrastructure serve as a traffic mitigation tool. However, in order for the City to encourage biking/walking as alternate means of transportation (and to ask developers to fund improvements), the infrastructure must be planned or in place, and the City must adopt and commit to a formal Bike Transportation Plan.

10. Maryland Bike Law

A bike is classified as a vehicle in the State of Maryland. Accordingly, bicyclists must obey the same traffic control devices as drivers. Likewise, motorists must understand that bicyclists have the same right to use the roadway as drivers. Bicyclists are encouraged to use the right side of the road in a shared manner with vehicles where space is available, but are allowed to use the full travel lane where space is limited because of narrow lanes or on-street parking. Additional biking rules and regulations can be found at http://www.cpabc.org/mdlaws.htm.

11. Resources

1. Laurel City Internal Traffic-Count and Road Speed Profile Database;
2. AASHTO Guide for Development of Bicycle Facilities;
3. Manual on Uniform Traffic Control Devices (MUTCD), Chapter 9;
4. AASHTO – A Policy on Geometric Design of Highways and Streets "The Green Book";
5. "Improving Conditions for Bicycling and Walking – A Best Practices Report" USDOT, FHWA Reports, January 1998;
6. Landis, Bruce. "Real-Time Human Perceptions: Toward a Bicycle Level of Service," Transportation Research Record 1578 (Washington DC, Transportation Research Board, 1997).
7. Pucher, John and Buehler, Ralph. "Making Cycling Irresistible: Lessons from the Netherlands, Denmark, and Germany." *Transport Reviews*. Vol. 28, No. 4, July 2008.

11.1 Bicycling-related Links

- MDOT Cycle Maryland:
  http://www.mdot.maryland.gov/newMDOT/Planning/Bike/Cycle_Maryland.html
- MD-SHA Bike Map and Information: http://sha.md.gov/Index.aspx?PageId=677
- Bike Maryland: https://www.bikemaryland.org/
- Prince George's County MNCPPC Trails: http://www.pgparks.com/Your_Parks/Trails.htm
- Washington Area Bicyclist Association: http://www.waba.org/
- Find a Bicycle Advocate near you:
  https://www.bikemaryland.org/resources/advocacy-organizations/