

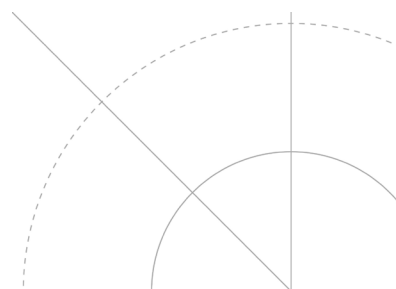
## APPENDICES

Appendix A: List of References

Appendix B: Concepts and Comments

Appendix C: Engineer's Estimate of Probable Cost

Appendix D: Supporting Information



## APPENDIX A: LIST OF REFERENCES

- ❖ VDOT Road Design Manual, Appendix A(1)
- ❖ VDOT IIM-TE-384.1: Ped. Crossing Accommodations at Unsignalized Approaches
- ❖ VDOT IIM-LD-200.11: Interchange Access Report Guidance
- ❖ VDOT Traffic Data, Albemarle County (2022)
- ❖ VDOT Crash Map and Crash Data
- ❖ VDOT Pedestrian Safety Action Plan
- ❖ VDOT Statewide Bid Tab Query (Q2, 2023)
- ❖ VDOT Route 20 Multi-Use Trail Concept Design (Kittelson & Associates, 2020) *see appendix*
- ❖ USGS 3D Elevation Program Data (LiDAR, 2016)
- ❖ Albemarle County Comprehensive Plan, Southern Urban Neighborhood Parks and Green Systems Plan (2015)
- ❖ Bike Route 76 Corridor Study (Thomas Jefferson Planning District Commission, 2015)
- ❖ Route 20 SUP Planning Level recommendations, Piedmont Environmental Council (2019)
- ❖ Charlottesville to Monticello & Beyond: Ped. and Bicycle Connections Planning Study (Dept. of Urban and Environmental Planning, UVA school of Architecture, 2017)

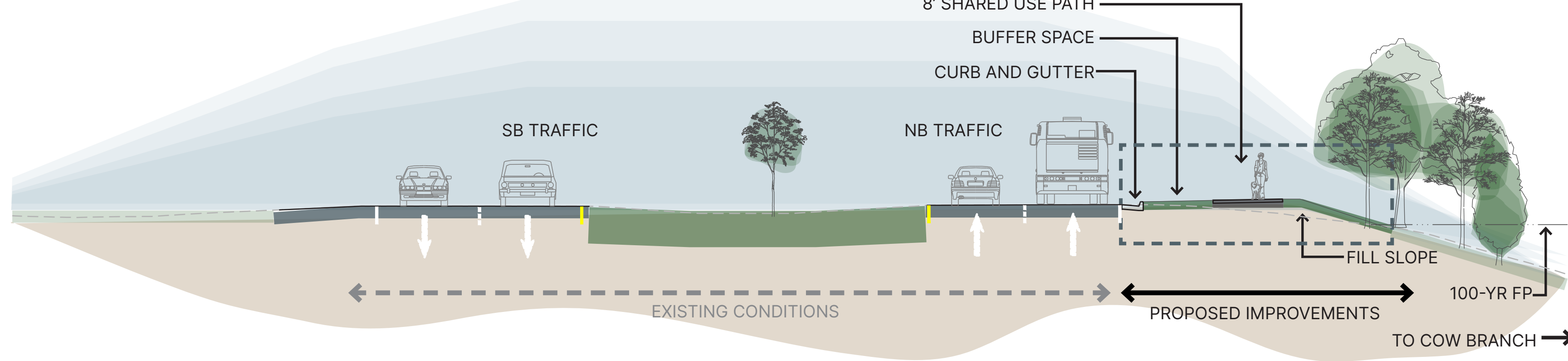
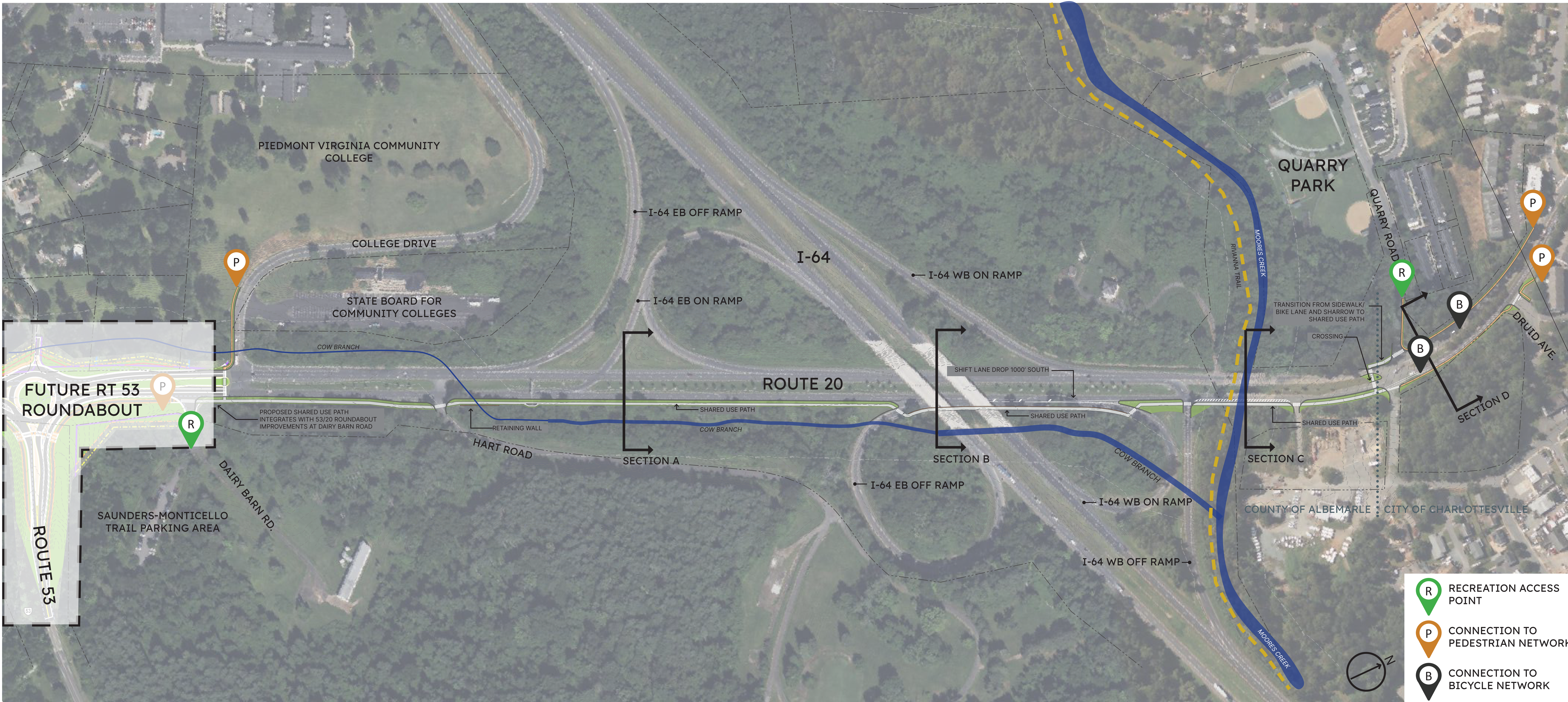
## **APPENDIX B: CONCEPTS AND COMMENTS**

East Alternative Concept

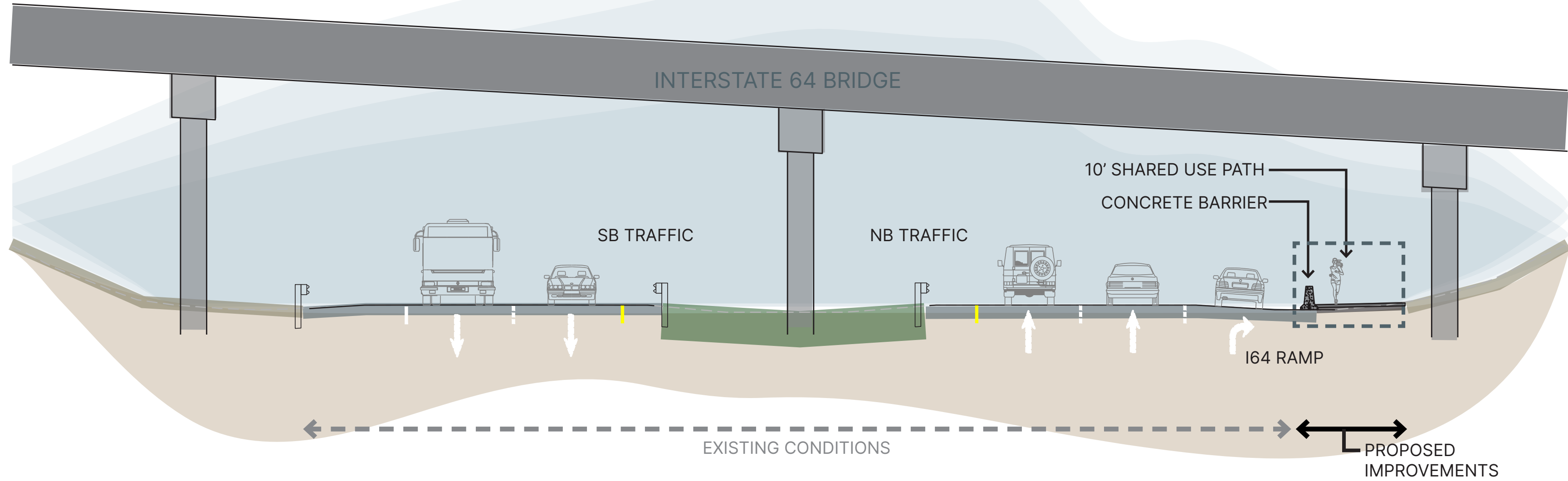
West Alternative Concept

Noteworthy Stakeholder and Public Comments

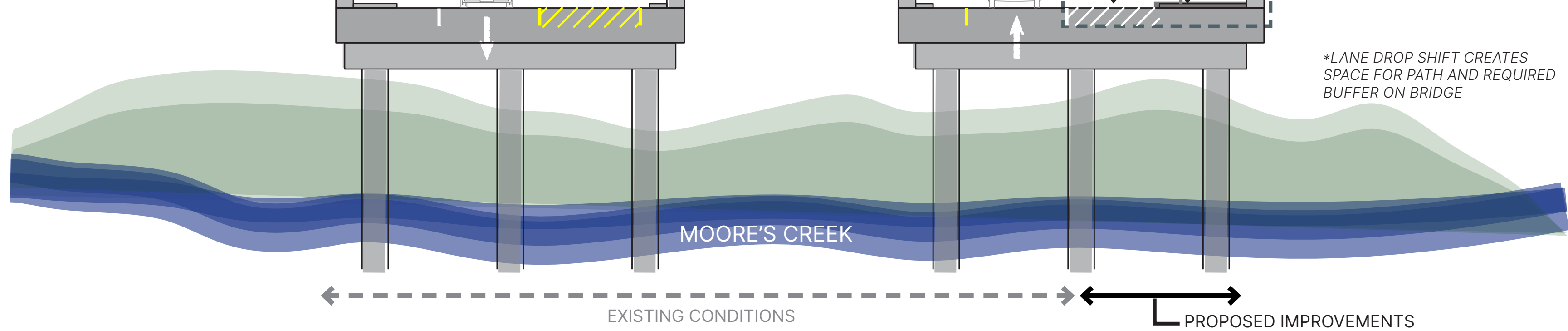




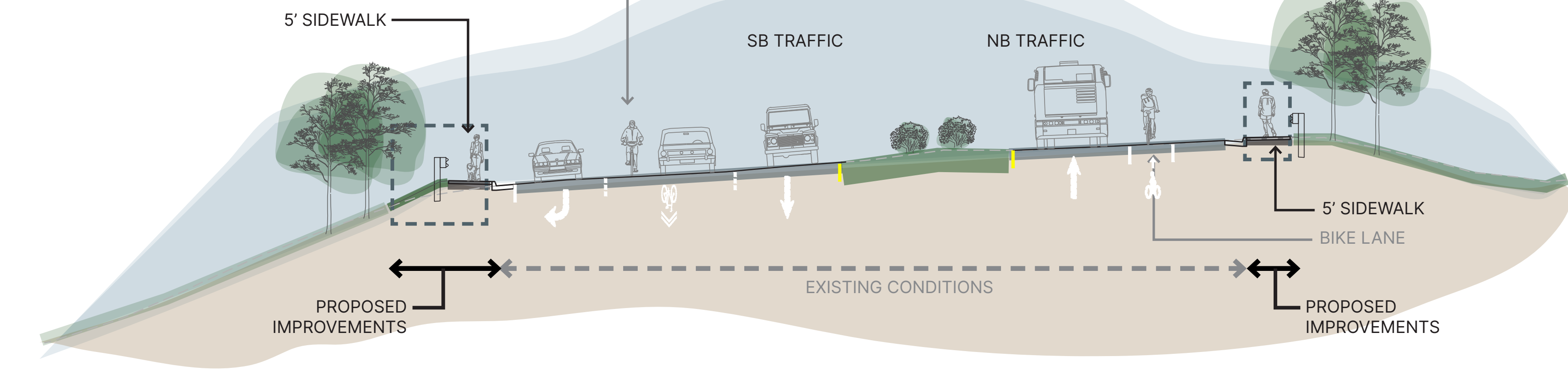
SECTION A



SECTION B

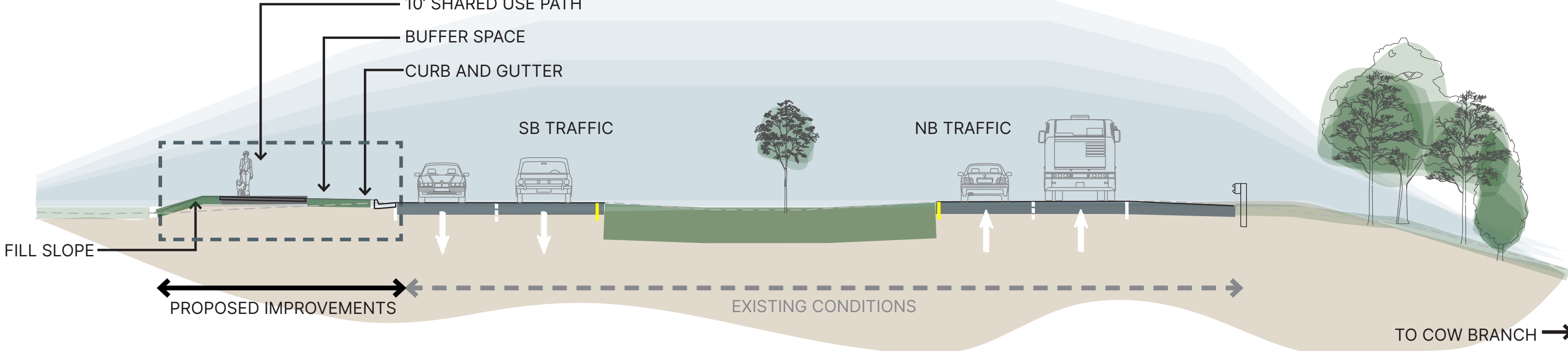
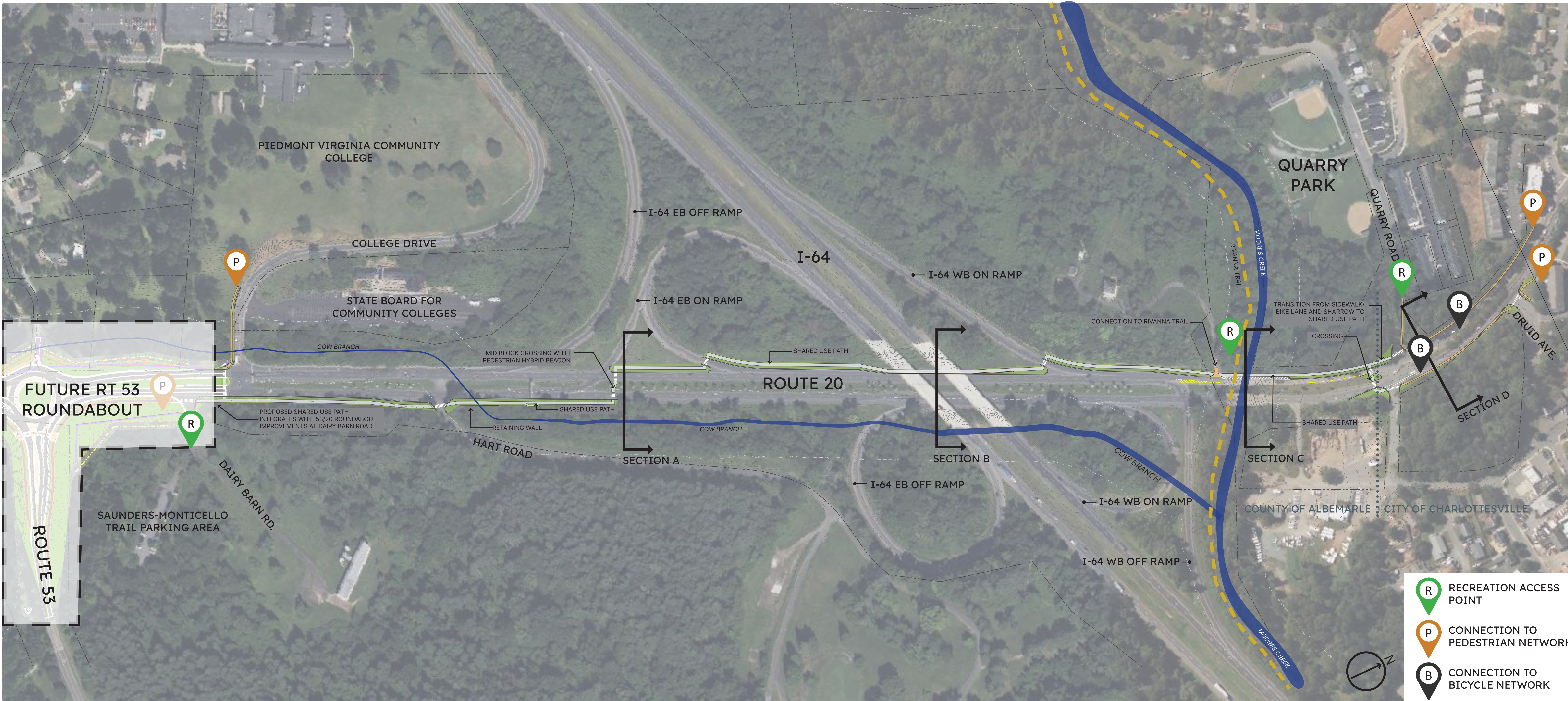


SECTION C

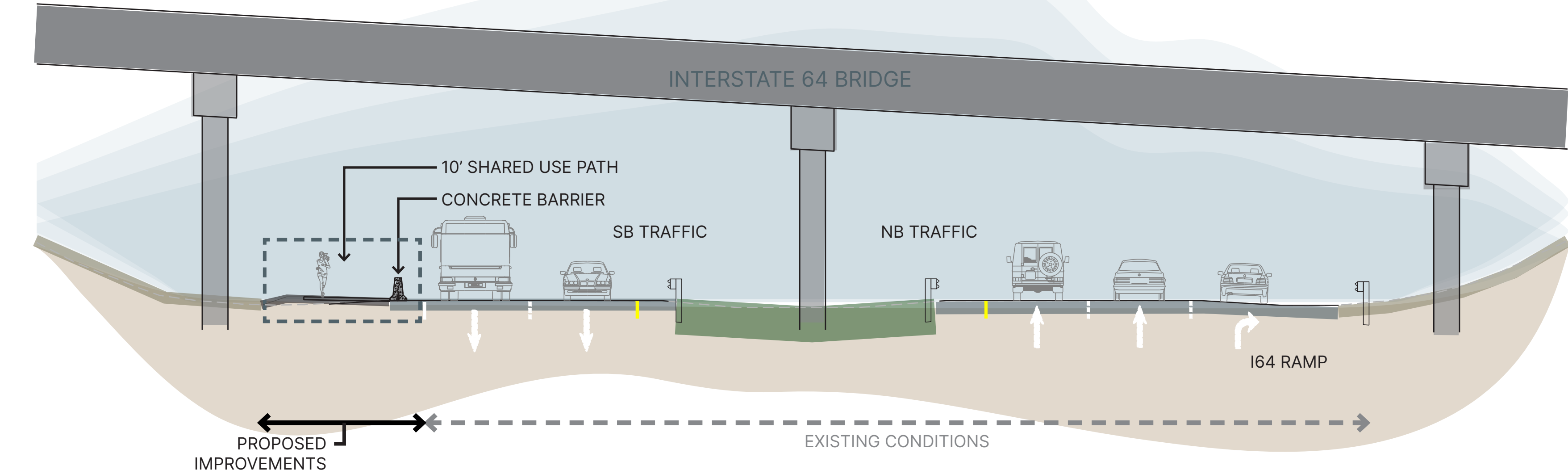


SECTION D

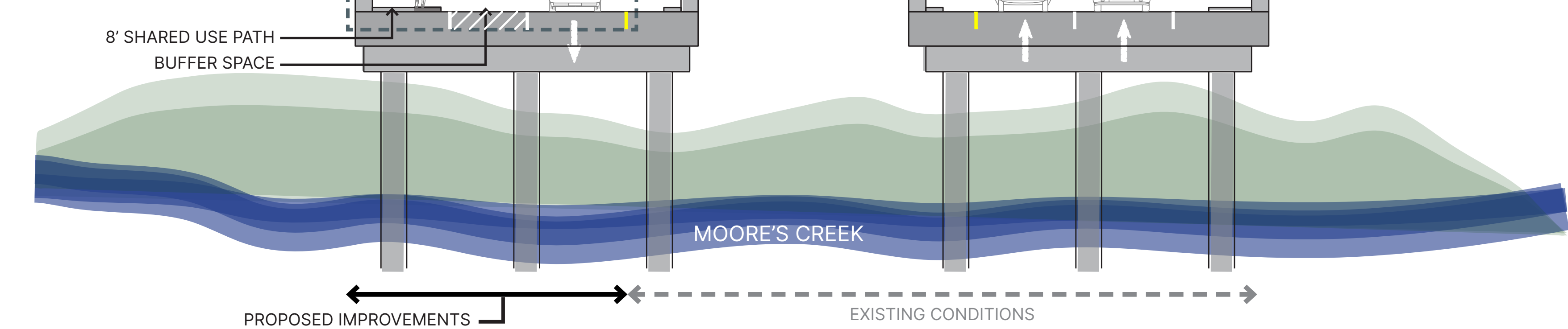




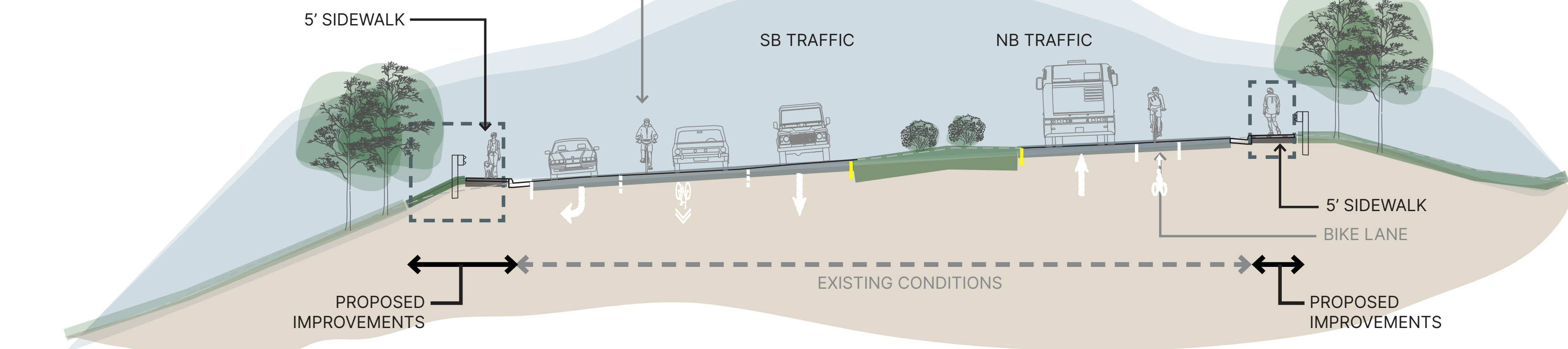
SECTION A



SECTION B



SECTION C



SECTION D



**VDOT Comment:** investigate eliminating the mid-block crossing and keeping the SUP on the west side of Route 20 until the proposed crossing at the PVCC entrance.

[illegible]

Figure 1: Possible modification to the Western Alternative suggested by VDOT.



*Photograph 1: Street view of Route 20, southbound, looking towards Cows Branch and PVCC.*



**Public Comment from CAC meeting:** Extend the SUP to the Druid Avenue intersection and provide a crossing there instead of at Quarry Road. The crossing at Quarry Road will be dangerous due to limited sight distances and speeding trends through that intersection.

Extending the SUP along the East edge of the road would not be difficult and would be an improvement to the East Alternative. Extending the SUP in the West Alternative would likely require some retaining along the steep slope adjacent to the road, but should be possible. It is critical to note that a crossing of Route 20 must occur in this vicinity to connect the proposed shared use path to the existing pedestrian and bicycle facilities which appear on both sides of the road. Due to the presence of Quarry Park as a pedestrian generator, pedestrian desire paths and volumes may warrant the crossing to be marked at Quarry Road. If this is the case, it is not recommended to mark a crossing at Druid Avenue, due to the proximity of the two intersections. A mid-block crossing study should be performed for both locations at the preliminary engineering stage to determine which location is the most appropriate for the needed crossing, and should consider roadway slope, desire paths, specific locations of pedestrian generators, sight lines, accident history, and traffic volumes (see VDOT IIM-TE-384.1).

A note on the mid-block crossing in this area: Any marked crossing will require a mid-block crossing study to be approved by VDOT, as the approaches along Route 20 at both intersections are uncontrolled. The current roadway was built for two lanes in both directions but has been striped to be one lane in each direction in this area. Any proposed improvement should provide curb extensions or bulb-outs to not only provide a shorter crossing distance, but also increase available sight distances and act as a traffic calming measure. This improvement appears feasible at either intersection. Lastly, it is notable that the limits of this study extend into the City several hundred feet, and both of these intersections are within City limits and will require coordination with the City to implement these improvements.

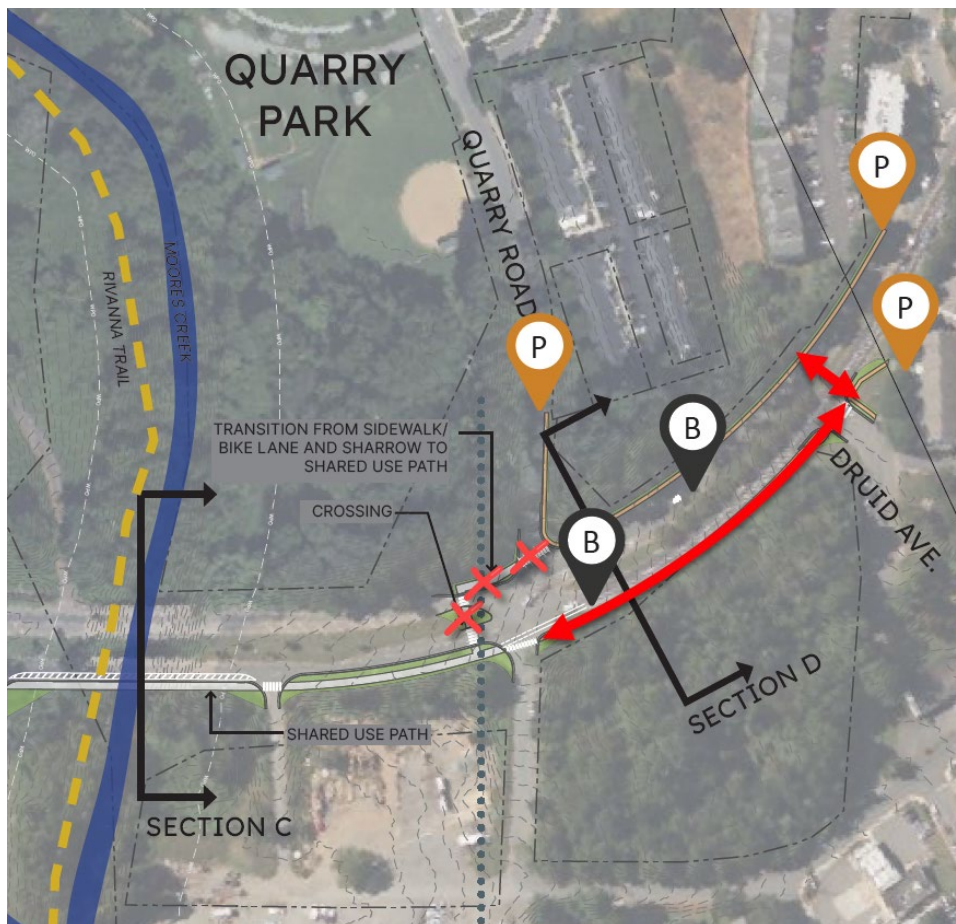


Figure 2: Possible extension of SUP into City, East Alternative





Figure 3: possible extension of SUP into City, West Alternative



## **APPENDIX C: ENGINEER'S ESTIMATE OF PROBABLE COST**

East Alternative

West Alternative



PROJECT INFORMATION		BASIS OF ESTIMATE	
Project Name:	Route 20 Shared Use Path Study		Code B - Preliminary Design
Project ID:	East Alternative		Pre-Final (Awaiting Final Coordination)
Location:	Albemarle County		Code C - Final Design
Date Prepared:	9/15/2023	30%	Custom Contingency Value

COST ESTIMATE SUMMARY				
DESIGN AND ENTITLEMENT	SUBTOTAL	ESTIMATING CONTINGENCY		TOTAL
SITE SURVEY	\$ 50,000.00	20%	\$ 10,000.00	\$ 60,000.00
DESIGN AND ENGINEERING FEE	\$ 450,000.00	20%	\$ 90,000.00	\$ 540,000.00
RIGHT OF WAY ACQUISITION	\$ -	20%	\$ -	\$ -
EASEMENT RECORDATION AND ENTITLEMENT	\$ 5,000.00	20%	\$ 1,000.00	\$ 6,000.00
DESIGN AND ENTITLEMENT TOTAL:				\$ 606,000.00
LABOR AND MATERIALS	SUBTOTAL	ESTIMATING CONTINGENCY		TOTAL
DEMOLITION	\$ 442,000.00	30%	\$ 132,600.00	\$ 574,600.00
EROSION & SEDIMENT CONTROL	\$ 275,000.00	30%	\$ 82,500.00	\$ 357,500.00
MAINTENANCE OF TRAFFIC	\$ 225,000.00	30%	\$ 67,500.00	\$ 292,500.00
SITE IMPROVEMENTS	\$ 2,526,000.00	30%	\$ 757,800.00	\$ 3,283,800.00
UTILITIES	\$ 150,000.00	30%	\$ 45,000.00	\$ 195,000.00
SIGNAGE AND MARKING	\$ 50,000.00	30%	\$ 15,000.00	\$ 65,000.00
LANDSCAPING	\$ 200,000.00	30%	\$ 60,000.00	\$ 260,000.00
LABOR AND MATERIALS TOTAL:				\$ 5,028,400.00
MOBILIZATION AND CONSTRUCTION ADMINISTRATION	SUBTOTAL	ESTIMATING CONTINGENCY		TOTAL
MOBILIZATION	\$ 230,000.00	20%	\$ 46,000.00	\$ 276,000.00
CONSTRUCTION ENGINEERING INSPECTIONS	\$ 50,000.00	20%	\$ 10,000.00	\$ 60,000.00
CONSTRUCTION SURVEYING	\$ 50,000.00	20%	\$ 10,000.00	\$ 60,000.00
CONSTRUCTION ADMINISTRATION	\$ 30,000.00	20%	\$ 6,000.00	\$ 36,000.00
MOBILIZATION AND CONSTRUCTION ADMIN. TOTAL:				\$ 432,000.00
ENGINEER'S OPINION OF PROBABLE COST: \$ 6,066,400.00				



PROJECT INFORMATION		BASIS OF ESTIMATE	
Project Name:	Route 20 Shared Use Path Study		Code B - Preliminary Design
Project ID:	West Alternative		Pre-Final (Awaiting Final Coordination)
Location:	Albemarle County		Code C - Final Design
Date Prepared:	9/15/2023	30%	Custom Contingency Value

COST ESTIMATE SUMMARY				
DESIGN AND ENTITLEMENT	SUBTOTAL	ESTIMATING CONTINGENCY		TOTAL
SITE SURVEY	\$ 50,000.00	20%	\$ 10,000.00	\$ 60,000.00
DESIGN AND ENGINEERING FEE	\$ 400,000.00	20%	\$ 80,000.00	\$ 480,000.00
RIGHT OF WAY ACQUISITION	\$ -	20%	\$ -	\$ -
EASEMENT RECORDATION AND ENTITLEMENT	\$ 5,000.00	20%	\$ 1,000.00	\$ 6,000.00
DESIGN AND ENTITLEMENT TOTAL:				\$ 546,000.00
LABOR AND MATERIALS	SUBTOTAL	ESTIMATING CONTINGENCY		TOTAL
DEMOLITION	\$ 385,000.00	30%	\$ 115,500.00	\$ 500,500.00
EROSION & SEDIMENT CONTROL	\$ 250,000.00	30%	\$ 75,000.00	\$ 325,000.00
MAINTENANCE OF TRAFFIC	\$ 225,000.00	30%	\$ 67,500.00	\$ 292,500.00
SITE IMPROVEMENTS	\$ 2,491,000.00	30%	\$ 747,300.00	\$ 3,238,300.00
UTILITIES	\$ 150,000.00	30%	\$ 45,000.00	\$ 195,000.00
SIGNAGE AND MARKING	\$ 350,000.00	30%	\$ 105,000.00	\$ 455,000.00
LANDSCAPING	\$ 100,000.00	30%	\$ 30,000.00	\$ 130,000.00
LABOR AND MATERIALS TOTAL:				\$ 5,136,300.00
MOBILIZATION AND CONSTRUCTION ADMINISTRATION	SUBTOTAL	ESTIMATING CONTINGENCY		TOTAL
MOBILIZATION	\$ 230,000.00	20%	\$ 46,000.00	\$ 276,000.00
CONSTRUCTION ENGINEERING INSPECTIONS	\$ 50,000.00	20%	\$ 10,000.00	\$ 60,000.00
CONSTRUCTION SURVEYING	\$ 50,000.00	20%	\$ 10,000.00	\$ 60,000.00
CONSTRUCTION ADMINISTRATION	\$ 30,000.00	20%	\$ 6,000.00	\$ 36,000.00
MOBILIZATION AND CONSTRUCTION ADMIN. TOTAL:				\$ 432,000.00
ENGINEER'S OPINION OF PROBABLE COST: \$ 6,114,300.00				



## **APPENDIX D: SUPPORTING INFORMATION**

### **Corridor Crash Data**

### **Ramp Crossing Examples (Courtesy of PEC Volunteer Research)**

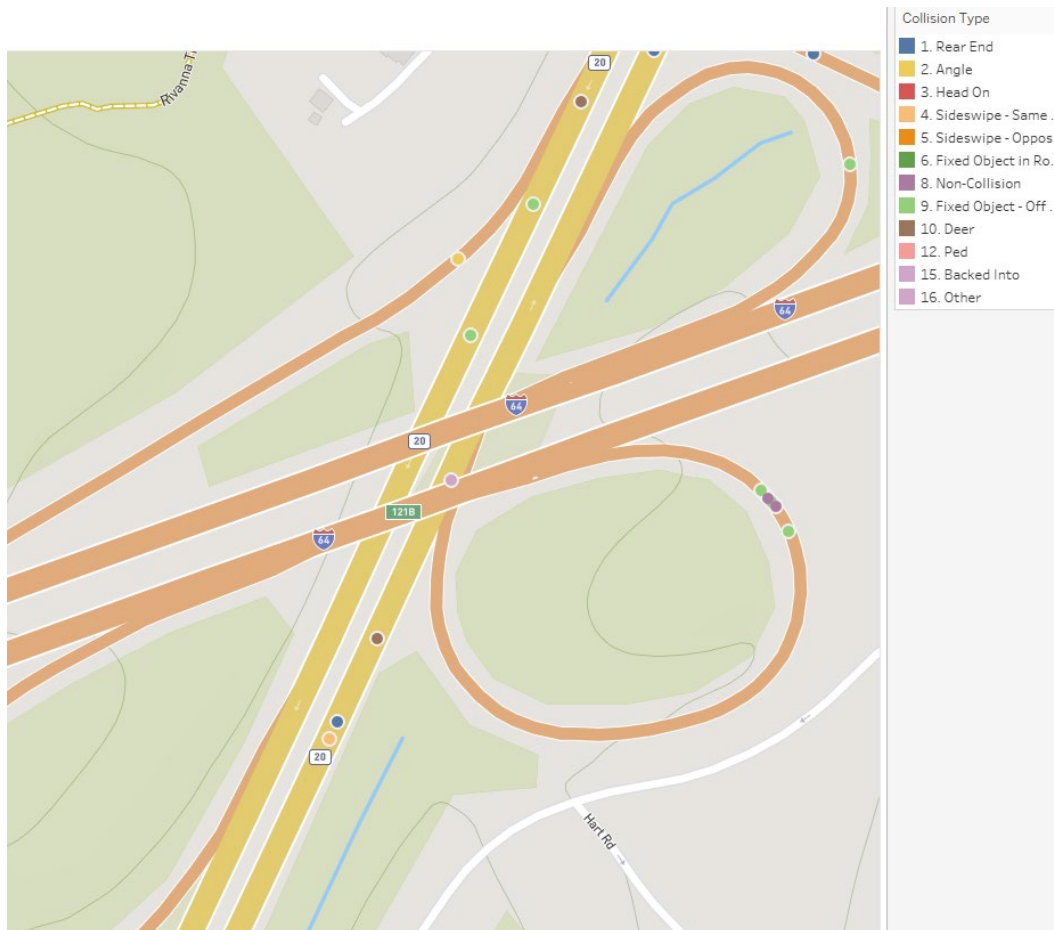


## Corridor Crash Data



Image D1: Crashes from Druid Avenue to northernmost interstate ramp.

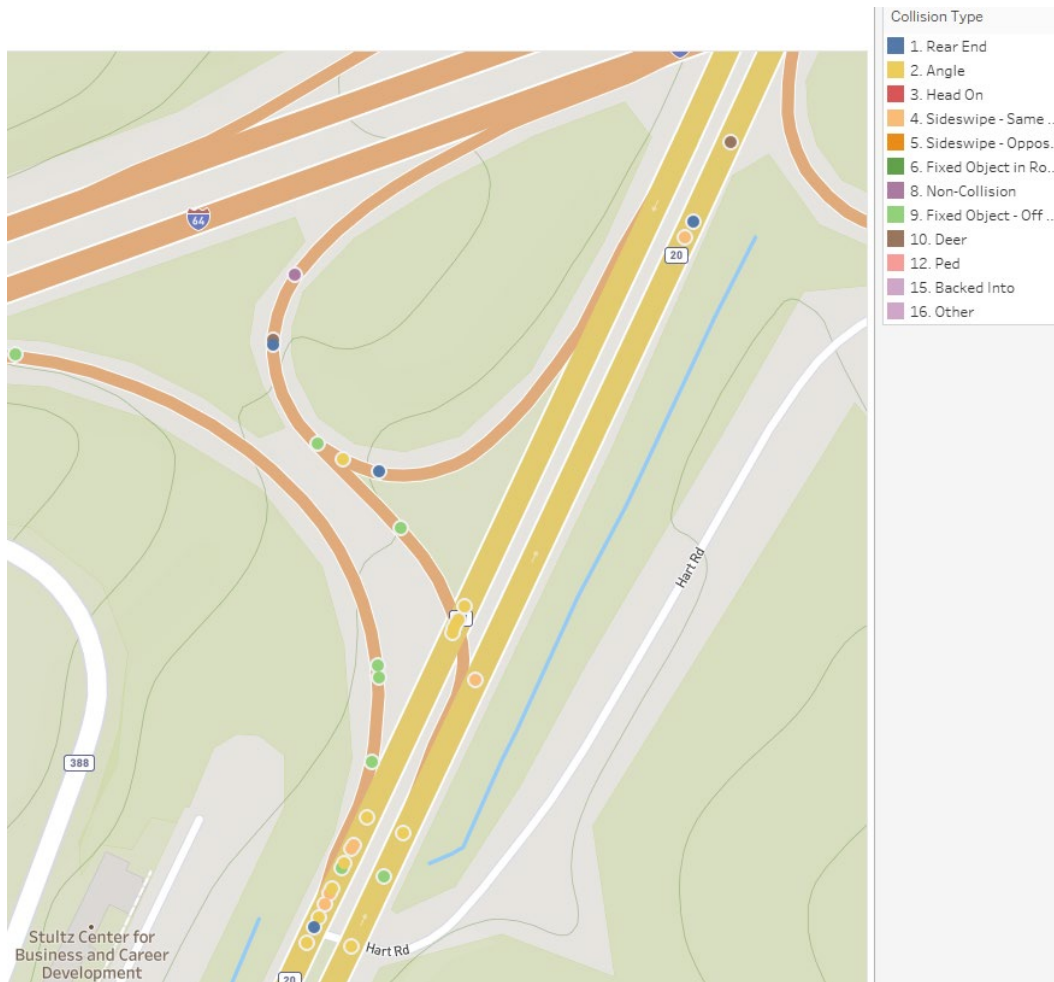
Note: The stop-controlled intersection of the I-64 WB off-ramp and Route 20 sees high crash rates. In 2019, channelization features were added to the left turn from the I-64 WB off ramp. This reduced the accident rate from 3.5 crashes/year before 2019 to 1.6 crashes/year after 2019. However, this area still sees many more crashes than its counterpart ramps, as the traffic volumes here are much higher.



*Image D2: Crashes along I-64 Interchange ramps (crashes on I-64 mainline not shown for clarity).*

Note: very few accidents occur at ramp intersections with low traffic volumes. Most crashes in the area are due to deer or driver inattention.





*Image D3: Crashes from I-64 Interchange to Hart Road.*

Note: crash rates in this vicinity justify a mid-block crossing in the West Alternative as opposed to the suggestion proposed by VDOT in which the path would continue along the western edge to the PVCC intersection.

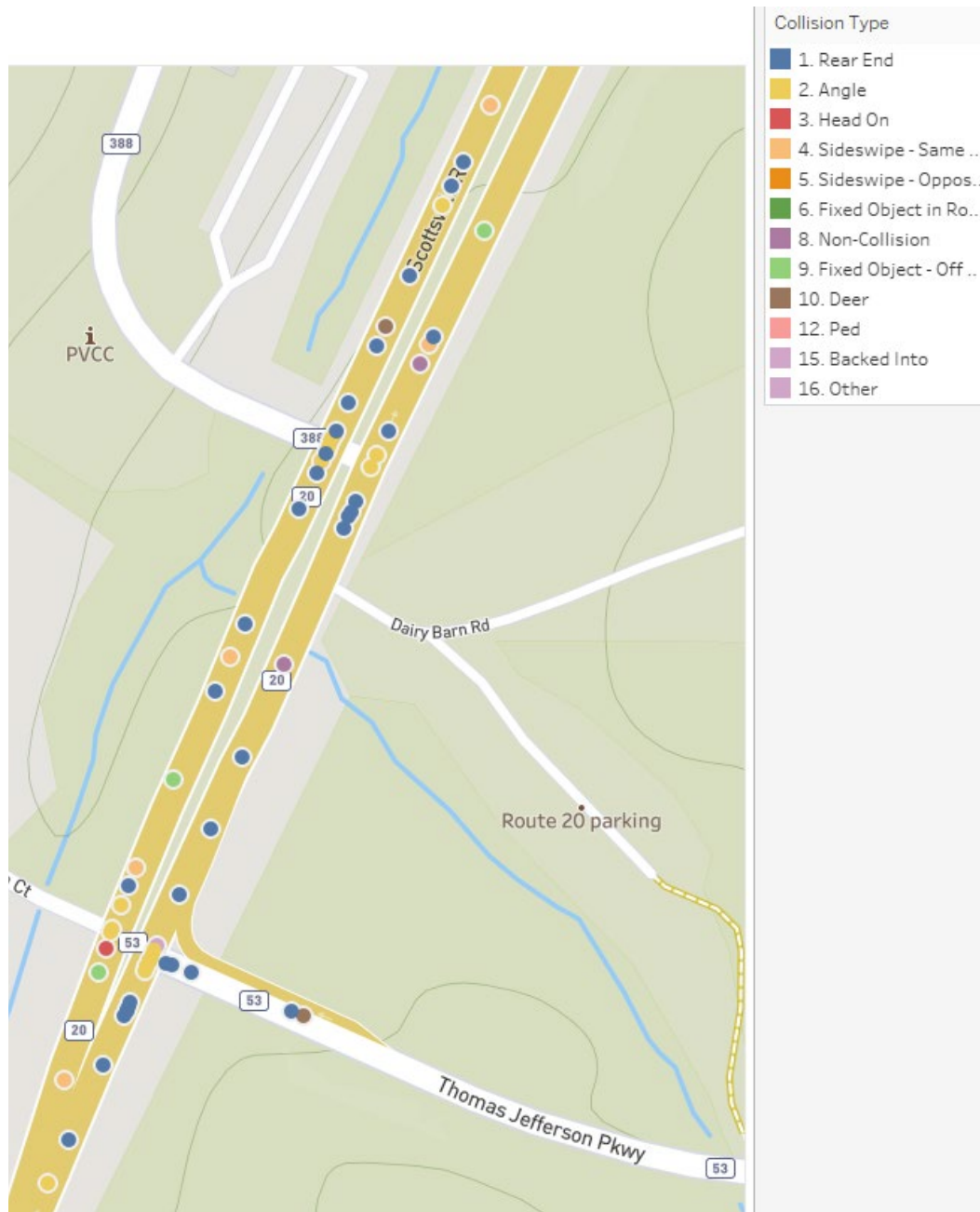


Image D4: Crashes from Hart Road to Route 53.



To: [Peter Krebs](#)  
Community Advocacy Manager  
The Piedmont Environmental Council

From: [James Van Vranken](#)  
Volunteer Researcher  
The Piedmont Environmental Council

Subject: Route 20 Research

Date: August 14, 2023

—

Dear Peter,

As you requested, I did some quick research about signage and other warning indicators that could be employed to make a crosswalk on an offramp safer. My overall recommendations and general notes follow.

I have also compiled images and specific examples of various treatments in actual use in the United States. Those are compiled [here](#).

Per your instructions, I have limited my research to the United States and focused on examples that are analogous to the Route 20 project.

### Recommendations

- Employ Rectangular Rapid Flashing Beacon (RRFB) at the crossing(s)
- Place a flashing beacon “upstream” on the off-ramp to warn drivers of pedestrians before the crossing is visible.
- Both sets of flashers should be on-demand, motion or both—not perpetually flashing.
- Paint “TRAIL XING” on the ramp before crossing is visible.
- Place the crossing far enough up the off-ramp to increase the field of view for all parties.
- Stop signs for cyclist and pedestrians on the SUP at the crossings

### [Examples of these Applications in Actual Use](#)

#### General Notes

##### Rectangular Rapid Flashing Beacon (RRFB)

“Flashing beacons can also be installed overhead **or in advance of an intersection.**” ([VDOT Brochure on RRFBs](#))

*Analyst’s comment: The curvature and limited sight distance (i.e. both the sign and the pedestrian won’t be visible at the same time) means that advance beacons (preferably flashing when activated) are probably advisable here.*

“The RRFB is not illuminated until a pedestrian activates it via a pushbutton **or by entering an automatic detection zone.**” ([VDOT “Bicycle and Pedestrian Treatments”](#))

*VDOT acknowledges that some RRFBs are triggered automatically, but I couldn’t find any examples in Virginia (only a handful in other states).*

“The RRFB is installed in combination with pedestrian, school, or **trail crossing warning signs**. They cannot be installed in conjunction with other signs.” ([VDOT Brochure on RRFBs](#))

The junction doesn't meet the [VDOT criteria](#) for an RRFB, because they only consider roads with two or more travel lanes. This would have to be an exception, so there isn't any guidance for it.

The only VDOT guidance for clover-leaf intersections is to build in the median if possible. “For interchanges with multiple merging and diverging ramps, such as cloverleaf interchanges and Diverging Diamond Interchanges (DDIs), it may be desirable to provide a pedestrian pathway through the median of the cross road to minimize pedestrian-vehicle conflict if space for a pedestrian facility in the median exists.” ([VDOT Memo: “Pedestrian Crossing Accommodations at Unsignalized Locations”](#), p. A17)

Guidance from DVRPC (Delaware Valley Regional Planning Commission)

For unsignalized single-lane on- and off-ramps, “use rapid flashing beacons, yield markings, an ADA-compliant crosswalk, and a bicycle intersection crossing to provide a safer crossing.” (<https://www.dvrpc.org/reports/19025.pdf>, p. 21)

Nice brochure about flashing beacons here:  
[https://epg.modot.org/files/4/46/900\\_Flashing\\_Beacons.pdf](https://epg.modot.org/files/4/46/900_Flashing_Beacons.pdf)

## **Ideas that probably won't be allowed**

Transverse rumble strips can be placed at decreasing intervals to give fast-moving drivers a sense of speed and warn them that they need to slow down. However, the [VDOT Standards for Transverse Rumble Strips](#) advises that “transverse rumble strips shall not be placed within the limits of curves that have advisory speed limits” (though I can't find out why).

[Pedestrian Hybrid Beacon](#): VDOT guidelines say the road has to have three or more lanes, with further requirements on traffic volume and speed limits.

## **Additional Notes**

The book [Recommended design guidelines to accommodate pedestrians and bicycles at interchanges: a recommended practice of the Institute of Transportation Engineers](#) looks like it will have relevant recommendations (pp. 9-21). Currently checked out at the VDOT library.

Locations:

[43.107440, -87.888269](#)

[38.877316, -77.083747](#)

[39.953869, -75.142226](#)

[47.591844, -122.309070](#) (article)

[41.064977, -73.862635](#)

[42.862366, -73.778118](#) (CPC, NY)

[37.227199, -121.976414](#) (Los Gatos)

[32.456825, -80.735117](#) (SC)

[43.512679, -70.431684](#) (Saco ME)



# Examples of highway ramp pedestrian crossings, for planned Route 20 shared-use path

James Van Vranken: [jamesvv143@gmail.com](mailto:jamesvv143@gmail.com)

Research conducted for Peter Krebs, Piedmont Environmental Council



Advance warning,  
flashing beacons, words  
on road (sometimes)

## Saco, ME

*Rt. 195 W-bound exit onto Main St/Portland Rd*

Cloverleaf off-ramp

TRAIL XING AHEAD signs in advance of the crossing

Button-activated flashing beacon at crossing

Stop sign for cyclists

Short crossing (narrow road, perpendicular crossing)



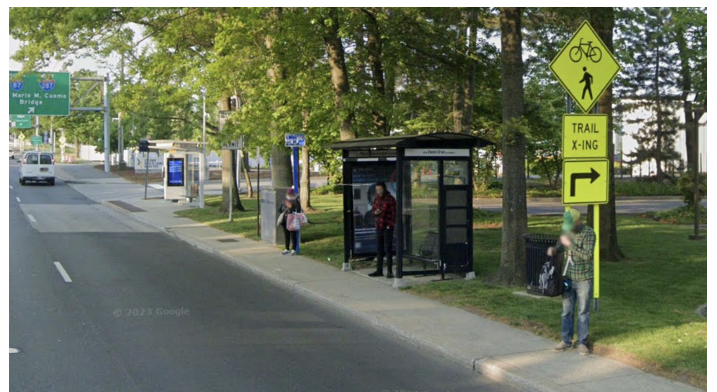
## Tarrytown, NY

*Broadway S on-ramp to 287 W*

TRAIL XING sign ahead of ramp

Button-activated RRFB

Crossing perpendicular to travel lane





## Seattle, WA

### *I-90 W-bound exit at Rainier Ave*

Flashing “ped ahead” beacon before crossing is in view

PED XING painted on road

The crossing is only paint, no buttons or lights (the ped signs say “use caution when crossing”)



## Philadelphia, PA

### *On-ramp from Race St onto I-95 N*

TRAIL XING sign first

Yield arrows, flashing beacons

Stop signs for cyclists



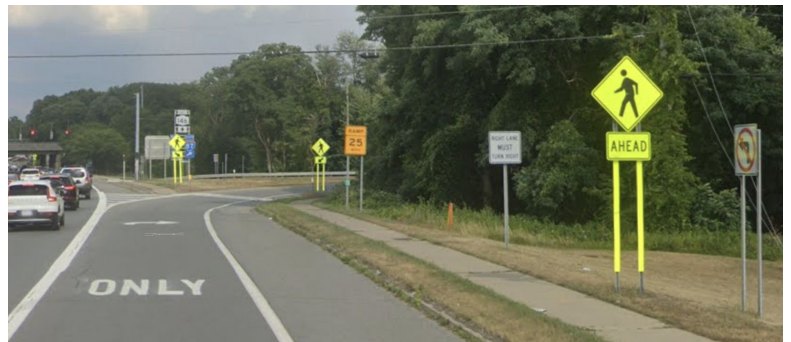
# No flashing lights

## Clifton Park Center, NY

*146 E onto 84 S*

3 large signs, one ahead of the others

Crossing not perpendicular to road, longer than it needs to be





## Arlington, VA

*Arlington Blvd S off-ramp onto  
Washington Blvd N-bound*

Sign ahead

TRAIL XING painted on road

No flashing lights

Crossing not perpendicular to  
road, longer than it needs to be

Signs potentially obscured by  
EXIT 25mph sign



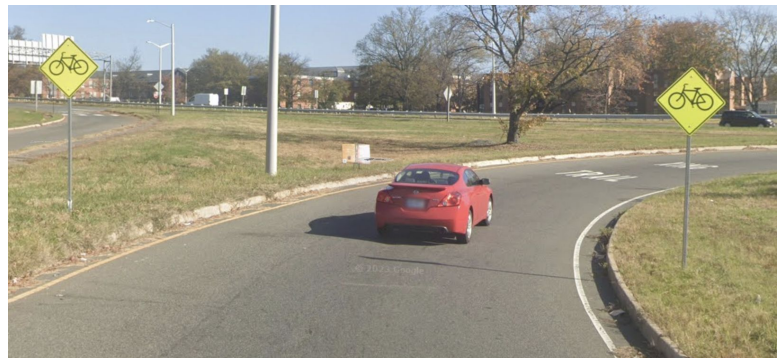
## Arlington, VA

*Washington Blvd N-bound  
on-ramp to Arlington Blvd W*

Bike signs ahead

TRAIL XING painted

Just a crosswalk, not  
perpendicular, stop signs for  
cyclists





# Other features

**Seattle, WA**

*Rainier Ave on-ramp to I-90 E*

Flashing beacons

Poles used to narrow roadway



## Auburn, IA

Thermal detection flashing beacons

<https://www.tapconet.com/case-study/auburn-iowa>



## Whitefish Bay, WI

RRFB with a flashing beacon 50m ahead of the crossing

