



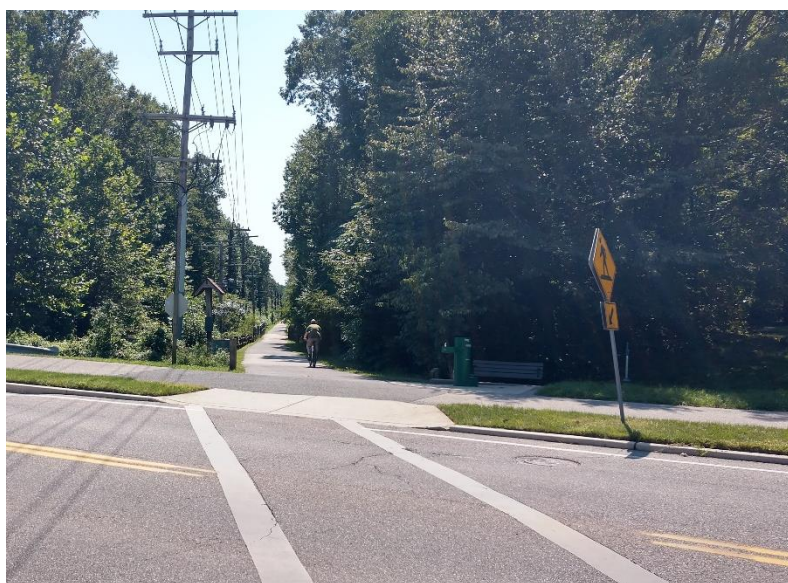
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& Hunt

FEASIBILITY STUDY FOR PEDESTRIAN-BIKE TRAIL FROM ODENTON TO BWI TRAIL

#H539615

Anne Arundel County
Department of Public Works

August, 2021





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1. Executive Summary

- The Anne Arundel County Department of Public Works received grant funding through MDOT's *Bikeways Network Program* for a feasibility study for a six-mile trail connection between the BWI Trail and the WB&A Trail northern terminus, near Odenton Town Center / Odenton MARC Station.
- This feasibility study outlines potential new trail alignments; conducts a high-level analysis of these alignments across multiple metrics; selects a preferred alignment and designs it to 10% plan level; documents all analysis data and findings; and provides recommendations for further evaluation during the project's 30% design phase.
- Both side of two corridors were initially explored for the feasibility of incorporating a new shared used path or trail: Telegraph Road (MD 170) corridor and the WB&A Road corridor.
 - A third option, not considered under this feasibility study, utilizes existing and County-planned trail segments that provide access to major employments centers. However, this option – which utilizes MD 176, Arundel Mills Blvd, Milestone Pkwy, and MD 175 – is several miles to the west of the study area, does not provide a direct route, and is already in various stages of planning of design.
- The County identified an ideal minimum trail cross-section that is 10' wide asphalt trail with 4' minimum grass buffer from any roadway. This trail cross-section was overlaid on *Existing Conditions* base maps, developed in CAD, for both corridors evaluated, in order to determine all obstacles and barriers to construction.
- In addition to the two primary north-south corridors, multiple options were developed for terminating alignments in the north and south end of the study area.
- Both primary alignments and terminating options were evaluated and compared for multiple factors: public input; safety and feasibility of overcoming safety challenges; design / constructability; right of way acquisition needs; environmental impacts; construction cost; and ability to connect to nearby destinations / neighborhood access.
- Public outreach was held virtually to solicit feedback, using an online survey. A project website with a recorded presentation and maps of potential alignments was provided to help respondents with their input and feedback. The public input was largely in favor of the WB&A Road alignment over the Telegraph Road alignment, citing calmer traffic and no interchange crossings.
- The preferred alignment, based on all the factors weighed, is to utilize the east side of the WB&A Road corridor from the BWI Trail south to Old Mill Road. The preferred alignment continues along the north side of Old Mill Road westward to Telegraph Road, where it transitions from the east side to the west side of Telegraph Road, just north of MD 32, prior to terminating at Odenton Road.
- Multiple new intersection safety improvements are recommended in concert with the preferred alignment, including new pedestrian signals and right-turn channelization removal at select locations. Other intersection improvements recommended for consideration in the 35% design phase include select lane reconfiguration and alternative traffic control devices to enhance trail crossing safety.
- The projected cost of the preferred alignment is \$6.8 million, with the primary driver of cost being the construction of the hard surface trail itself, along with retaining structures, ROW purchases, and utility pole relocations. Because the project is not likely to receive design and



construction funding in its entirety all at once, the preferred alignment was broken into several segments in order to prioritize the most impactful segments.

- The next step to progress the project toward construction is to conduct topographic survey, where needed, and develop 30% Design Plans with stormwater management concepts, lighting needs, permitting needs, and trail amenities identified and to finalize all design considerations identified in this report.

2. Introduction

The Anne Arundel County Department of Public Works received grant funding through MDOT's *Bikeways Network Program* for a feasibility study to connect the BWI Trail to the WB&A Trail and Odenton Town Center / Odenton MARC station. This six-mile connection is proposed as a ten-foot wide hard-surface multiuse path, buffered from roadway traffic. This feasibility study outlines potential alignments, specifically along the Telegraph Road (MD 170) corridor and the WB&A Road corridor. The study consists of a high-level analysis of the alignments across multiple metrics; selects a preferred alignment; documents all analysis data and findings; and provides recommendations for further evaluation during the project's subsequent 30% design phase.

a. Purpose & Need

The purpose of the feasibility study is to select a preferred alignment for a trail to connect the larger Odenton Town Center area – and northern WB&A Trail terminus – with the BWI Trail. The alignment is expected to generally run along one side of an existing north-south corridor/right-of-way, providing a dedicated asphalt trail that is buffered and grade-separated from any adjacent roadway traffic. In addition to joining the BWI Trail with the WB&A Trail, this alignment will ultimately connect to other planned major regional trails increasing the trail network across northern Anne Arundel County.

This proposed trail will also traverse multiple neighborhoods, expanding safe pedestrian and bike access to in the County, increasing commuting options, and providing non-driving options for retail, commercial, recreational, and institutional trips.

b. Goals & Objectives

The feasibility study will identify any barriers to construction and outline planning level costs for the preferred alignment, allowing for the identification of any large lead-time items needed for construction of the preferred route. Additionally, the study will identify potential for connections from the preferred alignment to adjacent neighborhoods/amenities.

The objective of the study is to collect sufficient data to recommend a preferred north-south trail alignment between the WB&A Trail and the BWI Trail. Study deliverables to achieve that objective begin with an analysis of existing conditions along potential public right-of-way (ROW) corridors (e.g. Telegraph Road and WB&A Road). Documenting the barriers and needs to provide a separated trail, in conjunction with public and stakeholder feedback, allow for a selection of a preferred alignment to provide safe passage of the trail through major highway crossings – including MD 32 and MD 100. Accordingly, the other major goal of this study is the documentation, via a report and 10% design package, of the data collection effort, public input summary, and preferred alignment section. Finally, the feasibility study will document the next steps and additional needs (survey, engineering, traffic analysis, ROW purchase, etc.,) required to develop the preferred alignment from 10% plans through 35%



design and preliminary engineering, to a final construction-level bid package. In summary, the ultimate goal of the study is to provide a conceptual design and supportive data for a preferred alignment – including costs and design tradeoffs, in order to make informed decisions during the final design stage.

c. Study Area

The study area incorporates a large portion of northern Anne Arundel County, roughly bounded by the BWI Trail in the North and Odenton Road, just south of MD 175, in the South. Odenton Road is the northern termination of the WB&A Trail and is adjacent to the Odenton MARC Station and Odenton Town Center. The western boundary is the west side of Telegraph Road (MD 170), while the eastern boundary is WB&A Road and Burns Crossing Road. The following map shows the study area as well as other nearby existing and County-planned trails – showing the interconnectivity potential of the larger regional trail system.

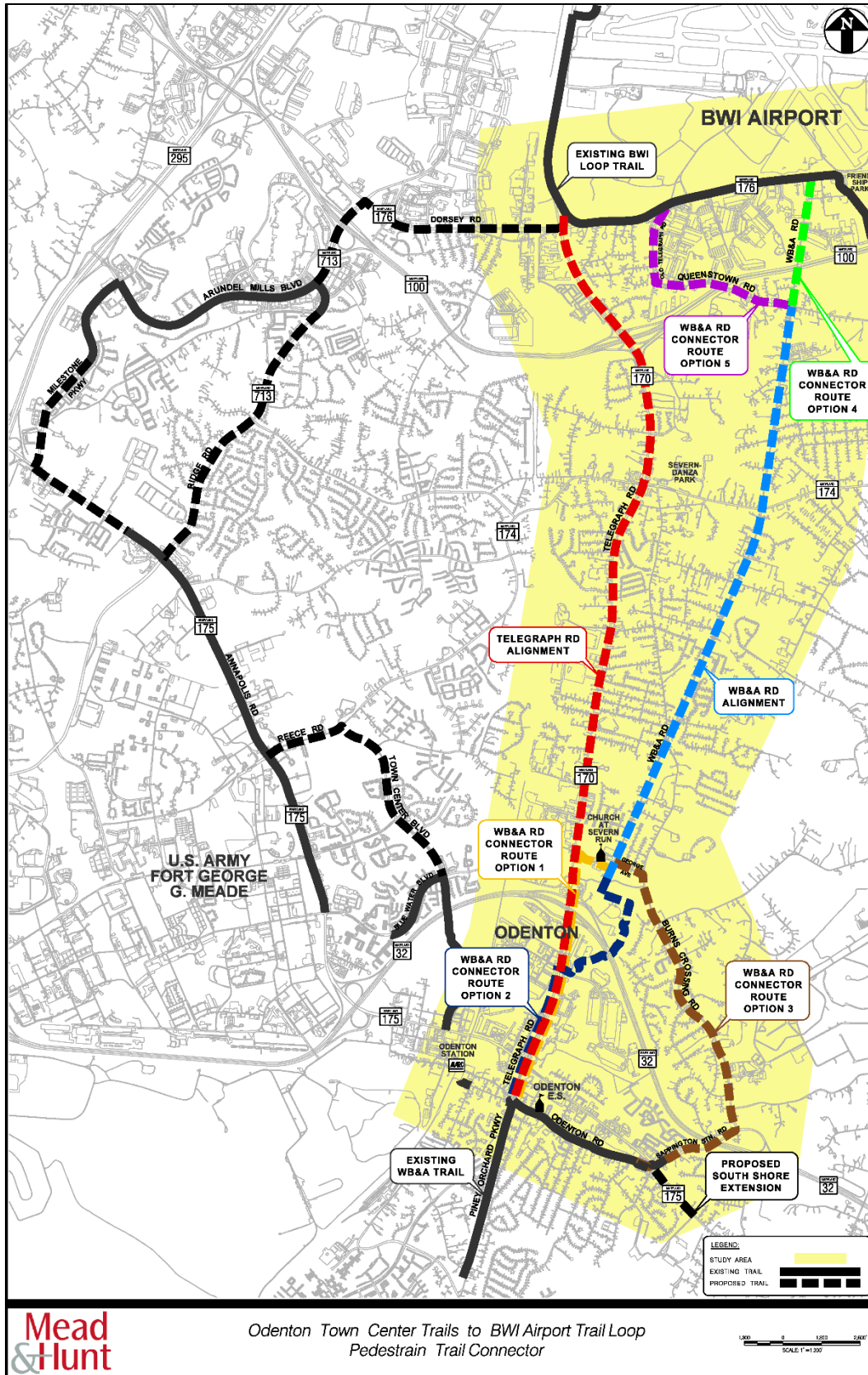


Figure 1: Study Area



Of note, the study area shows that a trail between BWI Trail and the WB&A Trail would require crossing several high-speed east-west arterials. Additionally, there are several potential trail termini alignments that could tie in with the WB&A Trail and the BWI Trail in the south and north, respectively. These optional termini alignments will be explored further in this report.

d. Study Methodology

The methodology of the feasibility study consisted of both a desktop and in-field investigation of two primary corridors – Telegraph Road and WB&A Road, with the goal of determining the most practical location for a regional trail to provide a direct connection from the BWI Trail to the current WB&A Trail terminus in Odenton. Critical steps in the study included:

- Data collection & analysis.
- Base mapping of existing corridor features (e.g. topography, ROW widths, environmental features, etc.).
- Alternative alignment development and impact analysis.
- Public presentation and stakeholder/public feedback.
- Preferred alignment selection.
- 10% design plans and documentation of study data and results.
 - Future evaluation and data needed to complete Final Design.

The feasibility study began with an extensive evaluation of existing conditions to develop a complete base map of the study area that shows:

- Right of Way (ROW) and property lines.
- Curbs, gutters, existing trails, sidewalks, road edges.
- Environmental features like Forest Stands, wetlands, rivers/creeks, and flood plains.
- Utilities, culverts, and steep embankments that could impact trail construction.

By overlaying the minimum trail typical section (a 10' minimum hard surface trail with a 4' minimum buffer from the street) to both sides of both primary north-south corridors (east and west side of the Telegraph Road and WB&A Road), the study was able to define and determine high-level barriers such as insufficient right of way, need for utility relocations, interchange ramp crossings, or need for structural retaining walls. Developing these maps and documenting the high-level impacts allowed for critical information to be presented in a public setting for feedback.

Public feedback, along with an alternatives analysis, led to the selection of a preferred alternative alignment. This alignment was designed to 10% detail, with planning level costs developed for each segment of the trail. Finally, this report documents all feedback, costs, and design details to be worked out in the next phase of preliminary engineering.

3. Existing Conditions

Assessing the existing conditions is the critical first step in determining a set of potential new alignments, as well as reducing them to identify a preferred alignment. By overlaying the desired trail cross-section on top of a to-scale CAD base map, potential construction barriers can be documented and high-level costs for designing and constructing workarounds can be determined. To develop a base map, several GIS layers from Anne Arundel County were obtained, including:



- Road edges, existing sidewalk and curb/gutter
- Topography of the study area corridors
- 2-foot contour lines
- Culverts and drainage swales
- Wetlands and flood plains, forest stands
- Existing and Planned Trails to identify potential new connections within the regional trail system
 - Odenton Trails Schematic Plan from 2007,
 - Odenton Town Center Master Plan,
 - Anne Arundel County Bike Master Plan,
 - Existing and proposed bicycle facilities (identified in the Pedestrian and Bicycle Master Plan (PBMP), 2003 and 2013 update or the current CIP),
 - Anne Arundel County Trails Map,
- Property lot lines and public right of way boundaries,
- Utility crossings/easements,
- Rail crossings/easements,

The above information was combined into CAD drawings, and relevant dimensions were added based on subsequent field visits. These field visits also provided information on retaining walls, culverts, guardrails and other potential barriers to installation of a new trail.

a. Primary Corridors in the Study Area

Anne Arundel County identified two primary corridors for a trail to connect Odenton with the BWI Trail:

- Telegraph Road (MD 170)
- WB&A Road

Additionally, several termination/connection alignments were developed at both the north and south termini – these will be discussed in more detail in the *Concept Development* section of this report. The two corridors vary widely in land use, vehicle volume, available public right of way.

While both corridors generally offer potential connections to the BWI Trail and the WB&A Trail, the corridors offer different walking and cycling experiences, have access to different destinations, and have differing adjacent land uses. Land uses are shown in Figure 2.

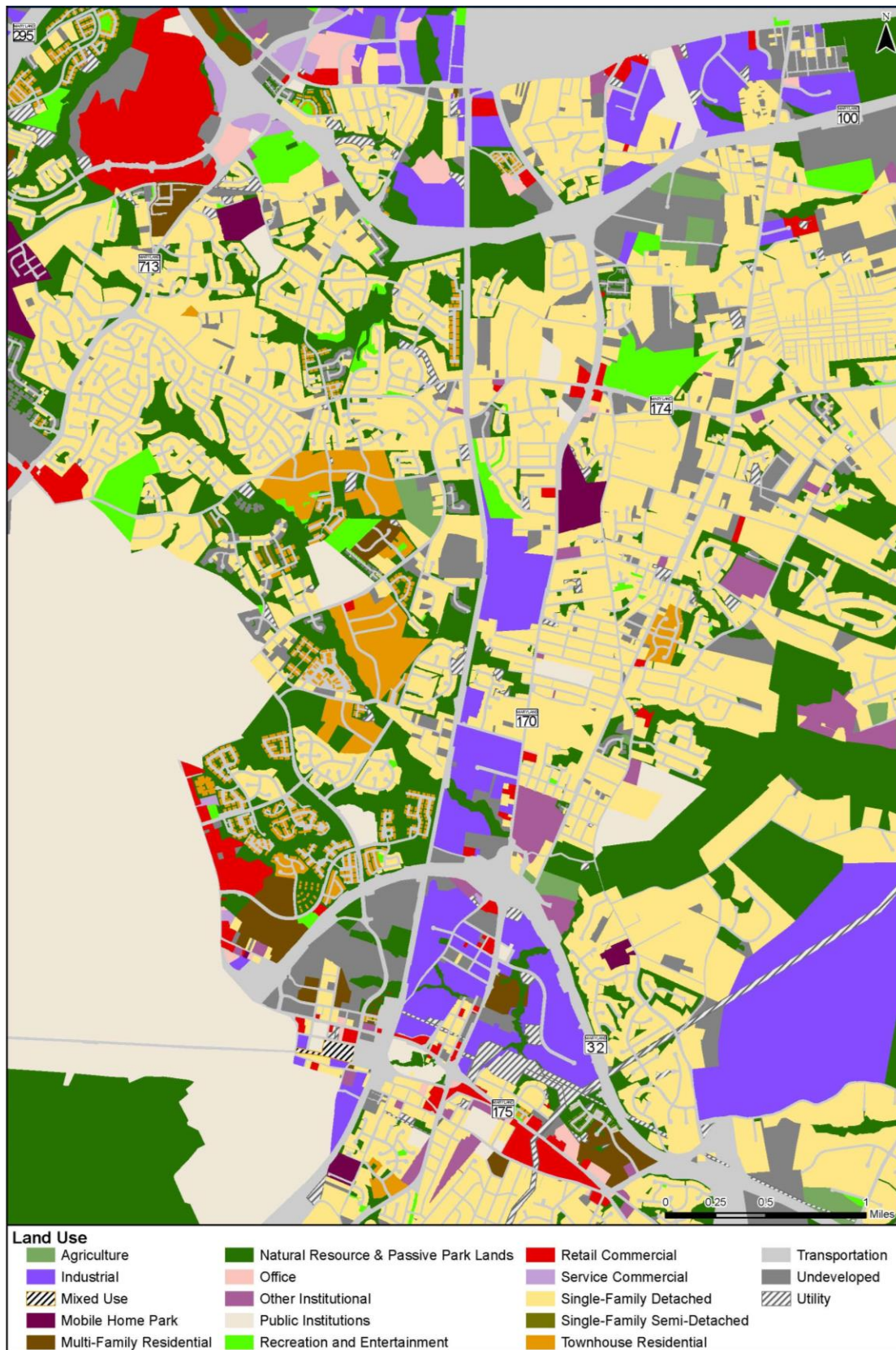


Figure 2: Land Uses within the Study Area



Telegraph Road is a minor north-south arterial with a mix of commercial, light industrial, and residential land uses. A view and typical roadway cross-section of Telegraph Road is shown in Figure 3 and Figure 4, respectively. There are few signalized intersections with east-west streets along Telegraph Road. The AADT of the road varies but is generally about 18,000 cars per day, south of MD 32 and 25,000 cars per day north of MD 32.



Figure 3: View of MD 170 (Telegraph Rd)

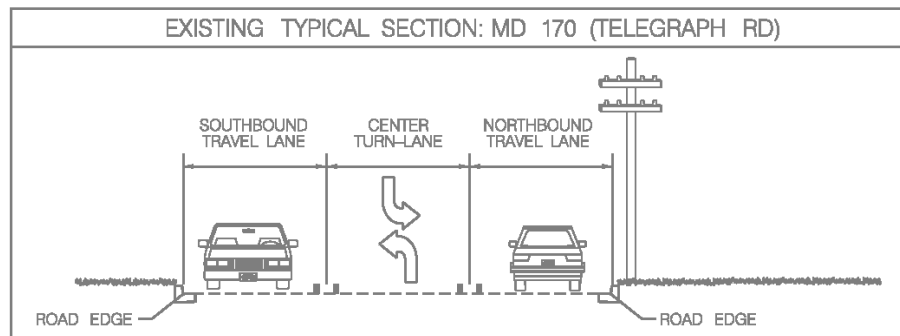


Figure 4: Typical cross-section of MD 170 (Telegraph Rd)

WB&A Road is a two-lane collector road that is residential, with mix of light industrial uses near its northern terminus with Dorsey Road (MD 176). A view and typical roadway cross-section of MD 170 is shown in Figure 5 and Figure 6, respectively. There are two signalized intersections with east-west streets along the WB&A Road corridor. The Annual Average Daily Traffic (AADT) of the road is very low in the southern end of the segment, as it is effectively a dead-end road but increases to about 4,000 AADT toward the northern terminus.



Figure 5: View of WB&A Road

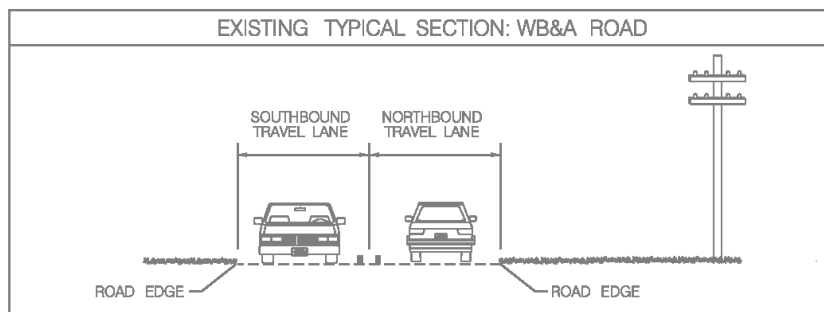


Figure 6: Typical cross-section of WB&A Road

b. Existing pedestrian and bike infrastructure

Along the MD 170 corridor, between Odenton and the BWI Trail, there is limited dedicated sidewalk, trails, and bike lanes available for pedestrian or bike travel. No pedestrian signals or crosswalks are present for crossing MD 170 at the MD100 interchange ramps, the signalized intersection of Donaldson Ave, the signalized intersection of MD 176 (just south of the BWI Trail), the signalized intersection of Crossroads Drive, and the interchange ramps of MD 32. The southern portion of MD 170, within the study area has sidewalk from Odenton Road, northward through the MD 175 intersection, including the channelized right turns. No bike lanes are present in the corridor; however, MD 170 has periodic 4-foot-wide shoulders.

Similar to MD 170, WB&A Road has limited sidewalk along the entire corridor between MD 32 and MD 176. A small segment of sidewalk exists along the east side of WB&A Road adjacent to industrial land uses, just north of MD 100. No bike lanes exist, and there are generally no shoulders provided, as the road is a neighborhood collector road, with low volumes and speeds.

c. Level of Traffic Street (LTS) Analysis

MDOT SHA uses Level of Traffic Stress (LTS) to rate road segments for bikability. It is also used to identify gaps in bikeable networks and to see how routes change across jurisdictions. LTS is primarily a quantitative measure with qualitative attributes. LTS scores range from 0 through 5, and roughly correspond to the usability of the facility across the full spectrum of riders, where 0 represents an easy



off-street trail that anyone can ride comfortably to 5 which represents a major highway/interstate which prohibits bicycle access. LTS variables include:

- Presence and quality of bicycle facility
- Traffic speed
- Traffic volume
- Presence of on street parking
- Buffer width between lane/shoulder and general travel lane
- Shoulder presence and width
- Traffic calming present
- Access Control

Generalized LTS, as a function of vehicle speeds and AADT for routes *with* bike lanes and *without* bike lanes, is shown in Table 1 and Table 2 , respectively¹.

Table 1: LTS for Routes with Bike Lanes

Number of thru lanes per direction	Bike lane width (ft)	Prevailing speed (mph)					
		< 25	30	35	40	45	50+
1 or unlaned	6+	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	4 or 5	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4
2	6+	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	4 or 5	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4
3+	any	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4

Table 2: LTS for Routes without Bike Lanes

Through Lanes per Direction	AADT	Prevailing speed (mph)						
		20	25	30	35	40	45	50+
Unlaned (no centerline) yet two-way	0-750	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	751-1500	LTS 1	LTS 1	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4
	1501-3000	LTS 2	LTS 2	LTS 2	LTS 3	LTS 4	LTS 4	LTS 4
	3000+	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
1	0-750a	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	751-1500a	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4
	1501-3000a	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
	3001+a	LTS 3	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
2	0-8000b	LTS 3	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
	8001+b	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4	LTS 4	LTS 4
3+	any AADT	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4	LTS 4	LTS 4

Based on these criteria and an evaluation of the corridors, all segments of Telegraph Road have an LTS of 4. WB&A Road has a better LTS, with the southern segment having and LTS of 2 and the northern segment, north of Quarterfield Road, having an LTS of 3.

¹ The Journal of Transport and Land Use. Vol 11, No. 1 [2018] pp. 815–831



d. Potential North and South Terminus Alignment Options

Several potential northern and southern alignment termination routes were identified within the study area:

- Telegraph Road, *Northern Terminus*
 - MD 176 Intersection
- Telegraph Road, *Southern Terminus*
 - Odenton Road Intersection
- WB&A Road, *Northern Terminus*
 - Queenstown Road at MD 176
 - WB&A Road at MD 176
- WB&A Road, *Southern Terminus*
 - Through a privately-owned parking lot (The Church at Severn Run) to Telegraph Road to Odenton Road
 - Via Old Mill Road to Telegraph Road to Odenton Road
 - Old Mill Road to Burns Crossing Road to Sappington Station Circle/Odenton Road
 - Via County-owned land through the Drainage Culverts under MD 32

Overview of Northern Terminus Options

As shown in Figure 7, a trail along either the west or east side of Telegraph Road requires a dedicated crossing of MD 176 (Dorsey Road) to reach the BWI Trail. There is a signalized intersection of Telegraph Road at MD 176; the nearest signalized crossing of MD 176 is a mile to the east (at Connelley Drive).

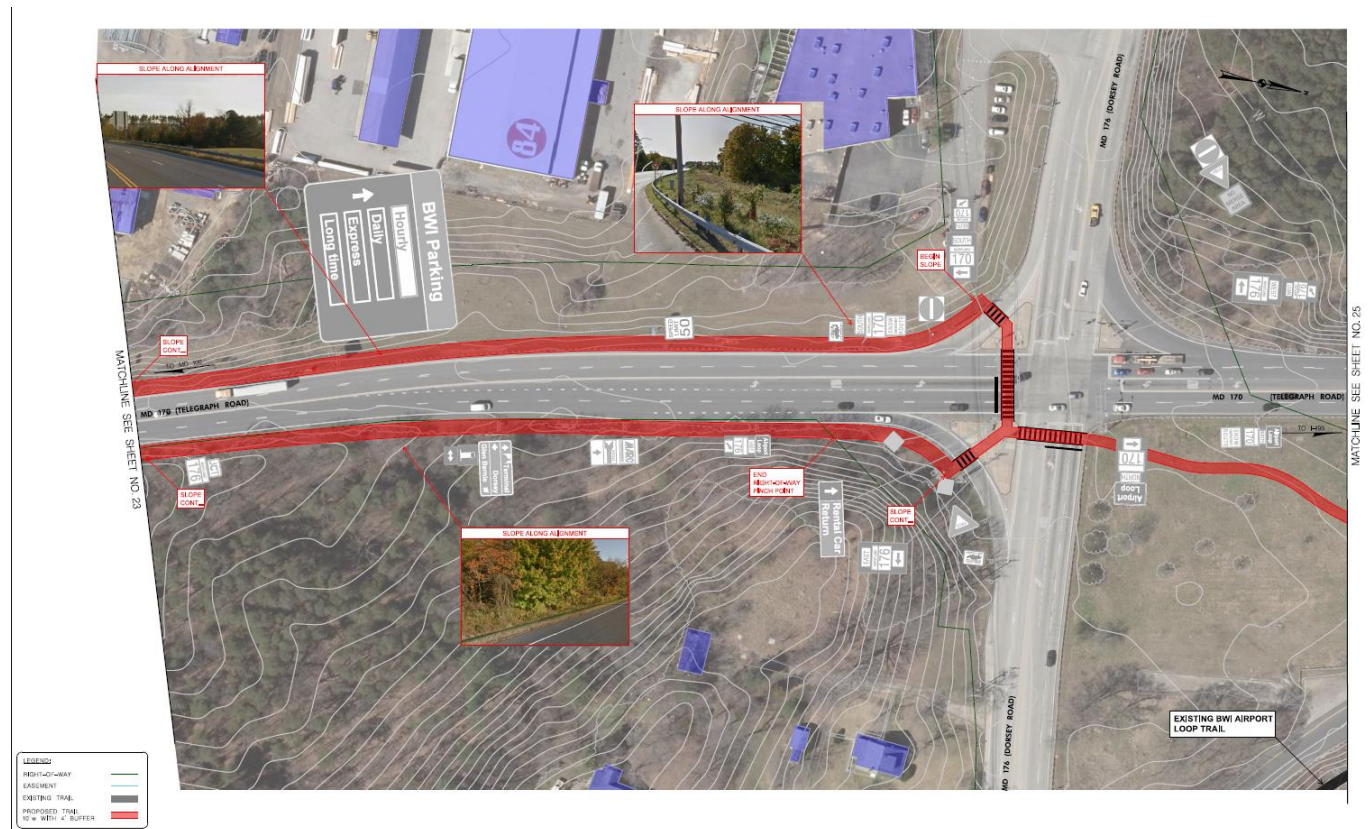


Figure 7: Trail layout along Telegraph Road with recommended MD 176 Improvements



Implementing the trail along Telegraph Road and then terminating it at the BWI Trail would require the installation of a pedestrian crosswalk and associated pedestrian WALK signals. Additionally, as shown in Figure 7, Telegraph Road has channelized right turns onto and from MD 170; these channelized turns would need to have new crosswalks or, preferably, have their channelization removed entirely. After crossing to the north side of MD 170, a path would be needed in generally northeastward direction, through the large channelization island, until a perpendicular crossing of the long and high-speed offramp from MD 176 eastbound to Telegraph Road northbound (See Figure 8). Ensuring a crossing that is perpendicular with vehicle traffic maximizes visibility between cyclists and drivers.



Figure 8: Potential northern termination of trail following Telegraph Road Alignment

For the WB&A Road route, the northern terminus can be: 1) at the intersection of MD 176 and WB&A Road (Figure 9); or 2) via Queenstown Road to Old Telegraph Road to MD 176 (Figure 10). Both of these options provide a grade-separated crossing of MD 100, without the need to cross uncontrolled off-ramps. Each has advantages and disadvantages, which will be discussed in a subsequent section.



Figure 9: Optional Northern Terminus of WB&A Rd Alignment at signalized intersection of MD 176

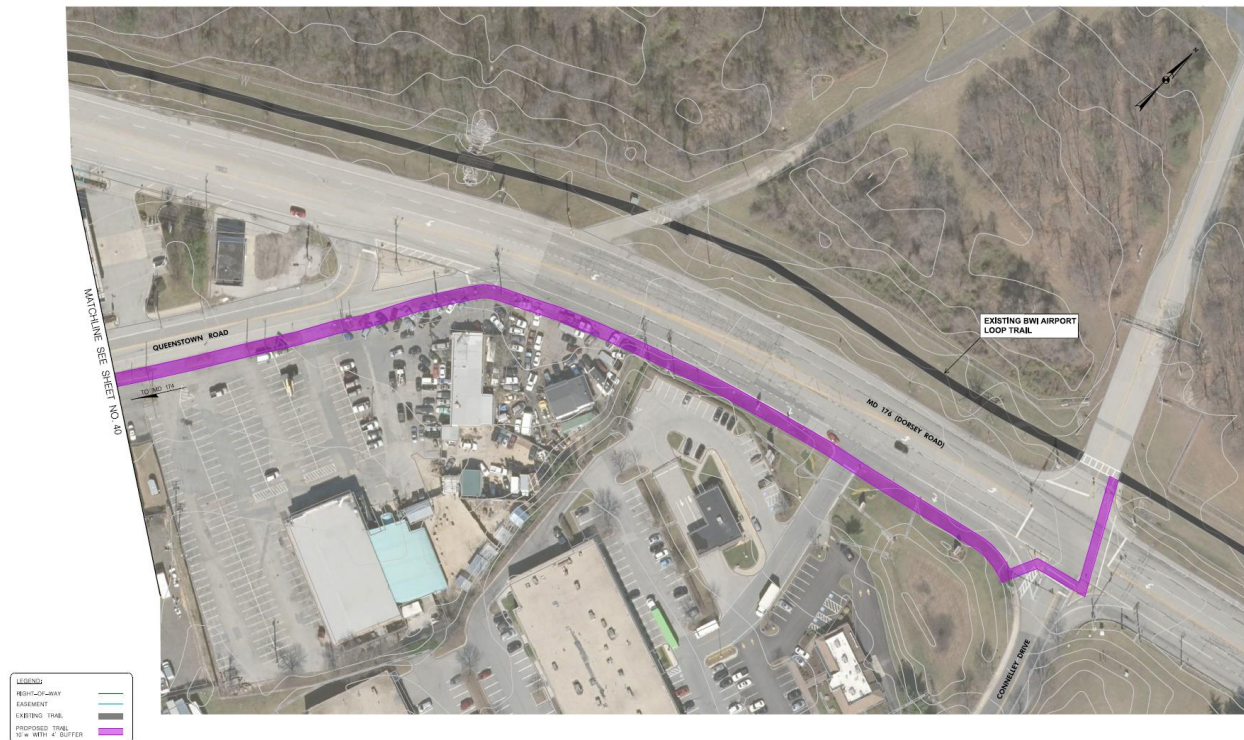


Figure 10: Optional Terminus of WB&A Rd Alignment via Queenstown Rd to Old Telegraph Rd

The southern terminus for the Telegraph Road alignment has one general terminus – Odenton Road, where the WB&A Trail current ends. This is shown conceptually in Figure 11. A crosswalk exists for all four legs of the intersection of Telegraph Road at Odenton Road. Additionally, Odenton Road has a side path from Telegraph Road in the west to Sappington Station Circle in the east, where a future South Shore Trail Extension is planned.



For the WB&A Road alignment, four options were identified to terminate the alignment at the WB&A Trail head. The first option is to utilize the parking lot of the church at the southern limits of WB&A Road, as shown in Figure 12; this church lot connects WB&A Road with Telegraph Road, where a trail would continue southward, connecting to Odenton Road as shown in Figure 11. The second option is to utilize Old Mill Road, just to the south of the WB&A Road dead end, as shown in Figure 13. Figure 13 shows a conceptual path connecting the end of WB&A Road south to Old Mill Road; in this figure, the path runs eastward toward Burns Crossing Road, where it would then travel south to Sappington Station Circle intersecting with the Odenton Road side path. An alternative option, not shown in the figure, is for the Old Mill Road side path to run *westward* toward Telegraph Road, where it could then ultimately terminate on either side of Telegraph Road at Odenton Road, as shown in Figure 11. A final option is for an off-road trail through County-owned land and utilizing the large stormwater management culverts under MD 32, before returning to Telegraph Road – see Figure 14.



Figure 12: Optional Connection between WB&A Road to Telegraph Road through parking lot



Figure 13: Optional connection via new path from WB&A Road dead end to Old Mill Road



Figure 14: Concept utilizing County-owned land and the culvert under MD 32

Advantages and benefits to each terminus option will be discussed in subsequent sections.

e. General Constraints within each Alignment

Both the Telegraph Road alignment and the WB&A Road alignment have several constraints to constructing not only a trail segment, but one that also has the previously stated goals of being buffered from the roadway, convenient, and safe for all users/abilities. Given that the ultimate trail alignment will be largely, if not entirely, located in the public right ROW, several obstacles to building a trail within each corridor were documented. In the WB&A Road corridor, constraints/obstacles include:

- Narrow overpasses over MD 100.
- Narrow bridge stream crossings with guardrails that will require a widened bridge deck to accommodate a side trail or an adjacent parallel bike/pedestrian bridge.
- WB&A Road dead-ends prior to intersecting with any other public street, requiring additional infrastructure – such as a new path – in order to continue onto a new public ROW corridor.
- Public ROW that is non-uniform in width.
- Signalized intersections with no pedestrian crossing phase or crosswalk for future trail users.
- Free right turn vehicle movements across a potential trail alignment.
- Utility Poles in the ROW.
- Proximity to forest conservation easements.
- Flood plains.
- Steep Side slopes.
- Available public ROW that can be *perceived* as privately owned/maintained.

In the Telegraph Road corridor, constraints/obstacles include:

- Interchange off-ramp crossings.



- Narrow bridge stream crossings with guardrails that will require a widened bridge deck to accommodate a trail or adjacent parallel bike/pedestrian bridge.
- Public ROW that is non-uniform in width.
- Insufficient ROW for a new trail at select locations.
- High-speed free right turn vehicle movements across potential trail alignments.
- Overhead utilities in the ROW.
- Steep side slopes.

The following section will explore these constraints in more detail, proffer potential solutions, and summarize the overall impacts and constructability of a new trail for each of the two corridors – as well as for the potential northern and southern alignment options.

4. Recommended Typical cross-section for Proposed Trail Alignment Options

Prior to developing potential trail alignments, the County identified minimum requirements for a new regional trail connection, to include trail width; trail buffer from any adjacent roadway; and protection (or grade separation) from any adjacent traffic lanes.

a. Recommended Trail typical section

To accommodate two-way bike and pedestrian traffic, the County determined that the minimum trail width to be 10 feet wide, with areas of expected heavier traffic (e.g., close to Parks, regional trail connection intersections, and trail heads) to be wider. Additionally, in order to improve usability and trail safety/comfort, the County determined that a minimum 4' buffer from the roadway is needed, with the ideal buffer being larger where ROW allows it. The buffer would also provide opportunity for stormwater management, as well as trail amenities like shade trees, lighting and benches.

Finally, the County desires that all trail segments along high-speed or high-volume roadways to be grade separated (e.g., behind a raised curb and gutter). Figure 15 and Figure 16 show how the ideal typical section for the trail would look for along both Telegraph Road and WB&A Road, respectively.

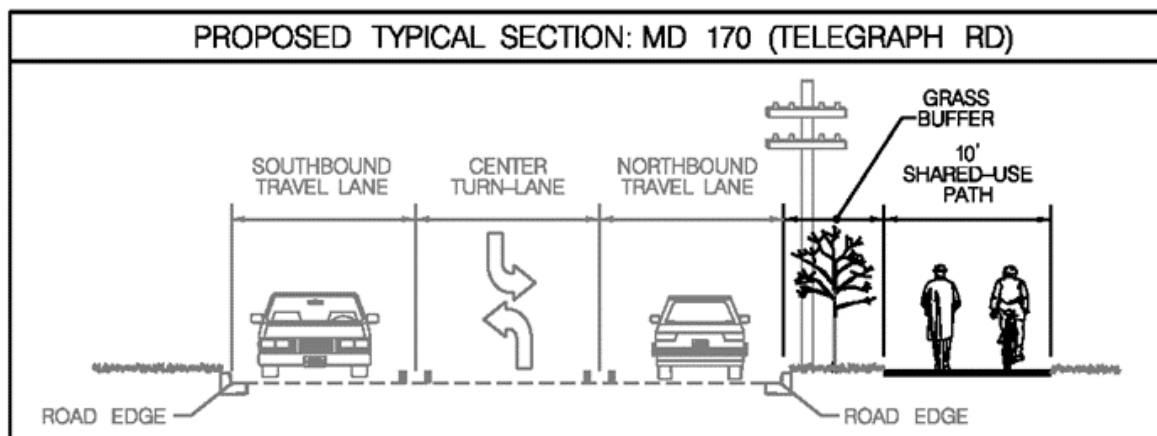


Figure 15: Proposed Typical Section along Telegraph Road (MD 170)

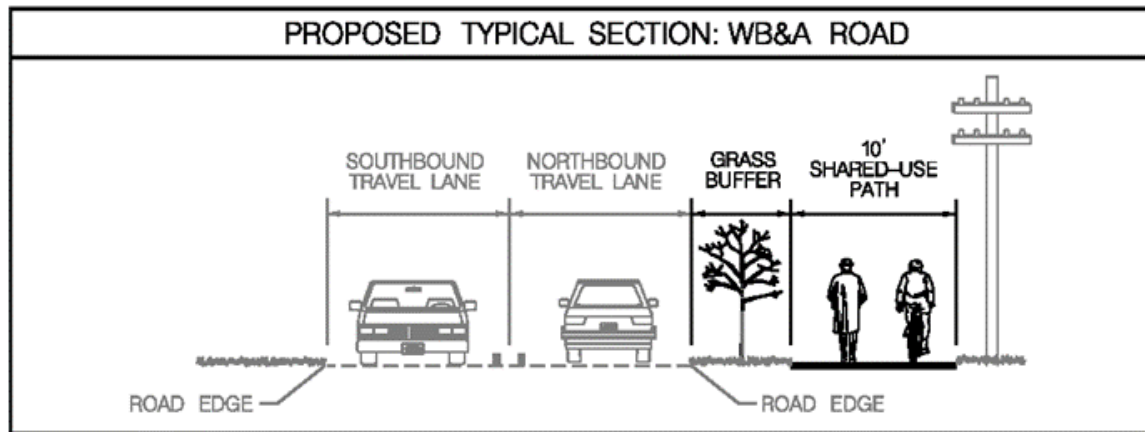


Figure 16: Proposed Typical Section along WB&A Road

Note that the trail along WB&A Road is shown to be at-grade with the roadway, instead of raised and behind a curb; this is because WB&A Road is generally a slower road with low traffic volume, and there is no curb and gutter system present for stormwater conveyance and management.

b. How a Trail Typical Section fits within the Telegraph Road Corridor ROW

The recommended typical section was overlaid on top of an *existing conditions* CAD base map. These base maps show where existing roads are within the public right of way, in addition to property boundaries, overhead utilities, wetlands, forest conservation easements, narrow bridges over creeks, interchange ramps, and contour lines and steep slopes. Overlaying the typical trail section shows, at a high-level, any obstacles and constraints toward constructing a buffered trail along each side of Telegraph Road. The remainder of this section shows many of the primary constraints on both sides of the roads but is not inclusive. Appendix A shows all the constraints mapped comprehensively for the Telegraph Road Corridor.

Trail Constraints along the Telegraph Road Corridor

This section covers some of the major constraints toward implementing a buffered side trail on both the east and west side of Telegraph Road, beginning in the south.

Just north of Odenton Road, along the west side there are multiple commercial driveways and curbside overhead utilities, however, there is sufficient ROW and a relatively flat grade between Odenton Road and MD 175. Along the east side, there is a slope down toward a frontage road, a large high-voltage utility pole, and the entrance to a commercial building all within the desired alignment of a trail, as shown in Figure 17. Given the size of the utility pole and presence of a building in the Telegraph Road ROW, an east side trail would require utilizing the parallel frontage road (Railroad Ave) as well as diverting onto private property.

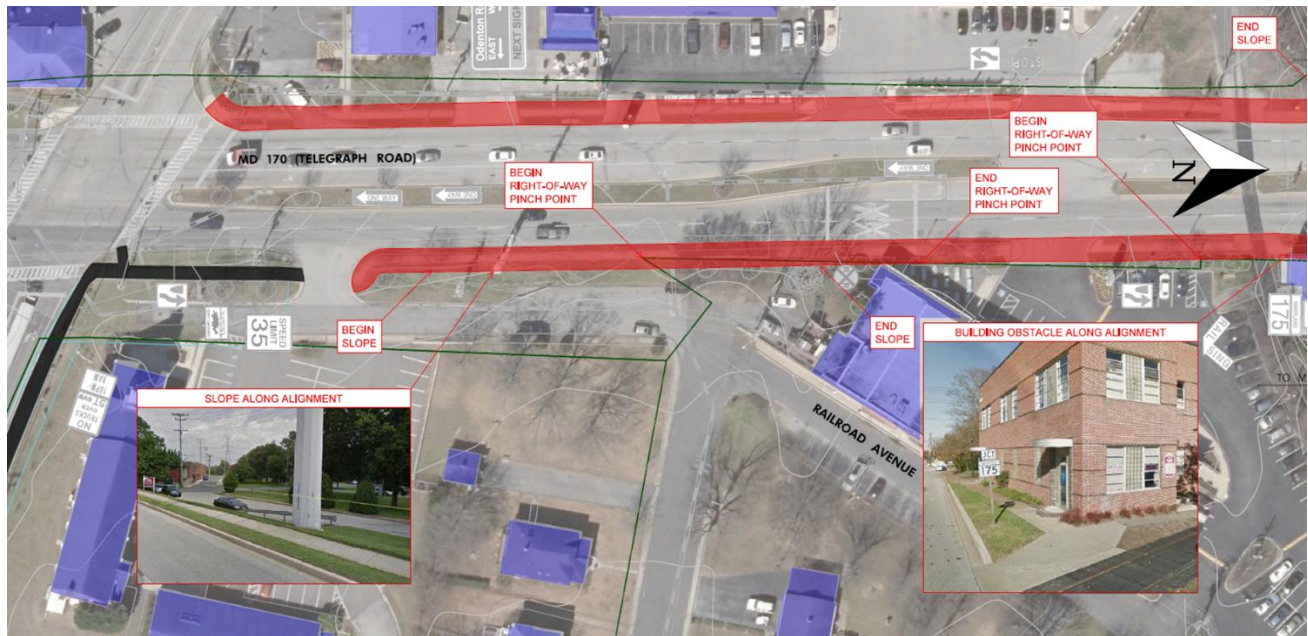


Figure 17: Overlay of a buffered trail along both sides of Telegraph Rd, south of MD 175

At the intersection of Telegraph Road with MD 175, there are channelized right turns and slopes at all four intersection quadrants, as shown in Figure 18. Without geometric improvements to the intersection, crossing MD 175, on both the east and west sides, would entail mitigating slide slopes at each impacted intersection quadrant. There is sidewalk and a pedestrian-activated WALK signal crossing along the east side of the intersection and a marked uncontrolled crosswalk along both east-side right turn channelized ramps, as well as the southwest channelized ramp. Removing the channelized right turn on either sides would eliminate the need for uncontrolled ramp crossings and would free up space to avoid the steep side slopes that would need either re-grading or retaining structures. Finally, the east side of the intersection has limited ROW for trail expansion (see solid green lines in Figure 18), requiring the purchase of new ROW or easements.

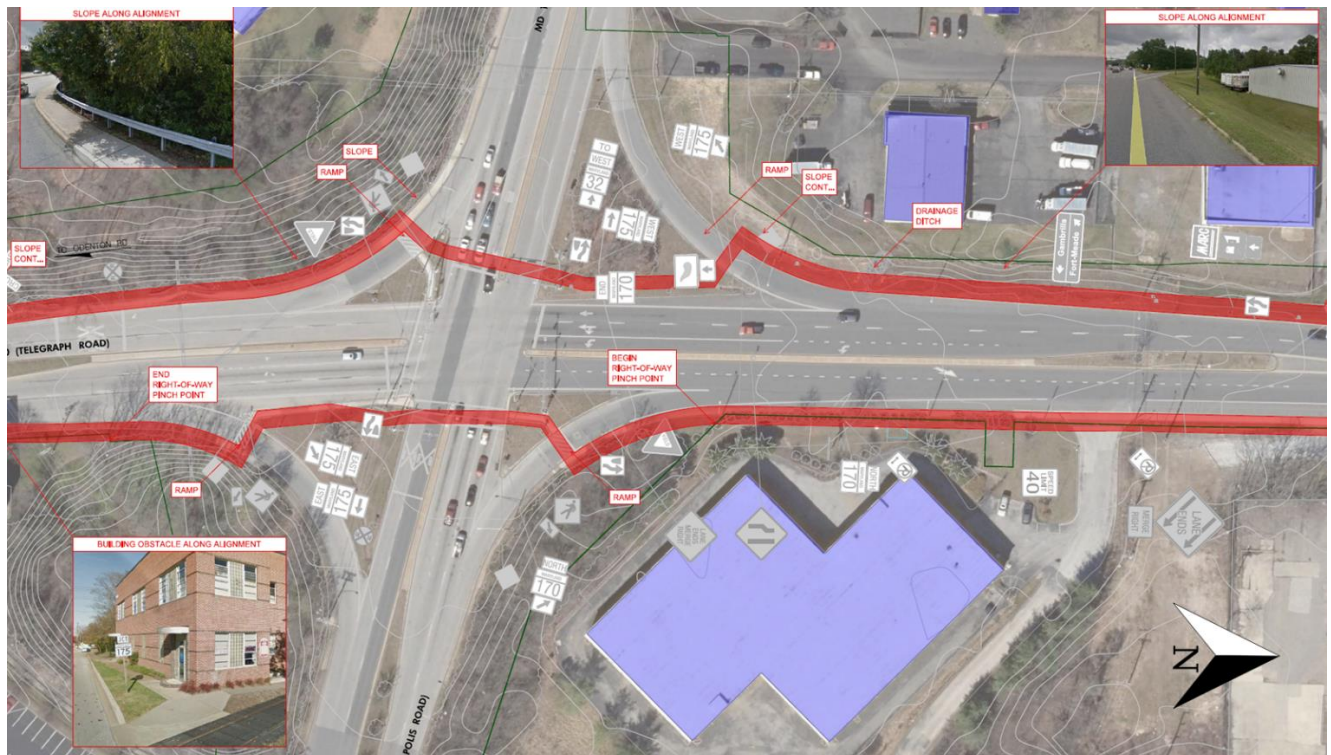


Figure 18: Overlay of a buffered trail along Telegraph Rd at MD 175

Heading north toward MD 32, available Telegraph Road ROW widens. However, the roadway transitions from a closed section to an open section, with variable-width shoulders and drainage/conveyance slopes on the east and west sides. Accommodating a buffered side path would require utilizing some or all of the shoulder width and potentially “piping” the side swales. Additionally, this segment of Telegraph Road would also need a closed section (e.g. curbed) with a raised path behind the curb; this would require periodic inlets, as well, if the drainage swales were to be retained.

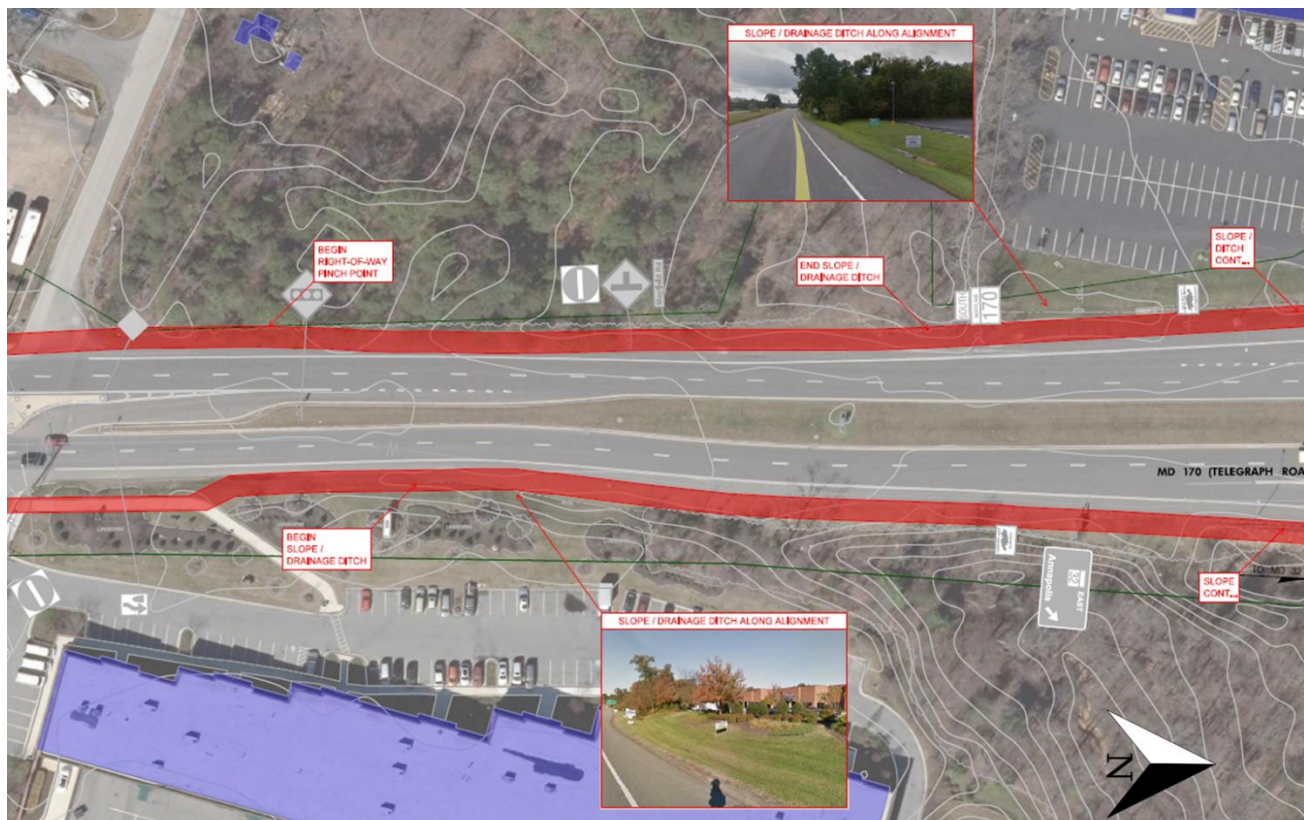


Figure 19: Telegraph Road, south of MD 32, highlighting open section roadway

Telegraph Road intersects with MD 32 at a grade-separated interchange, with Telegraph Road traversing underneath MD 32 and access control provided by signalized on/off ramps. All four right turns at the interchange are channelized, with varying degrees of side slope embankment. Any ramp crossing would entail uncontrolled trail crossings across the ramp, unless geometric improvements are made to remove the channelization. While there is ample ROW on both the east and west sides of Telegraph Road, the segment under MD 32 has rip-rap-covered embankments that limit the usable width available for a buffered trail. The west side of the underpass generally is flatter and wider, providing an opportunity for a buffered side path, while the east side has little space for any pedestrian-bike facilities – as shown in Figure 20.

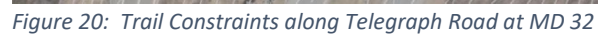


Figure 21: Telegraph Road, north of MD 32

In between Donaldson Ave (MD 174) and MD 100, Telegraph Road is largely residential with ample ROW for improvements. However, as shown in Figure 22, the roadway is open-section with drainage ditches on both east and west sides. While ample shoulder is available for conversion to a side path, it would need to be elevated with a curb or separated with a vertical barrier from general-purpose vehicle traffic.



Figure 22: Telegraph Road, in between MD 174 and MD 100

Additionally, MDOT SHA is planning roadway widening improvements along Telegraph Road at the MD 174 intersection. Roadway widening will occur along the east side of Telegraph Road, just north of MD 174.

Telegraph Road intersects with MD 100 as a grade-separated interchange, as shown in Figure 23. A potential trail alignment on either the east or west side would require crossing four interchange ramps, two of which are signalized and two of which are uncontrolled.

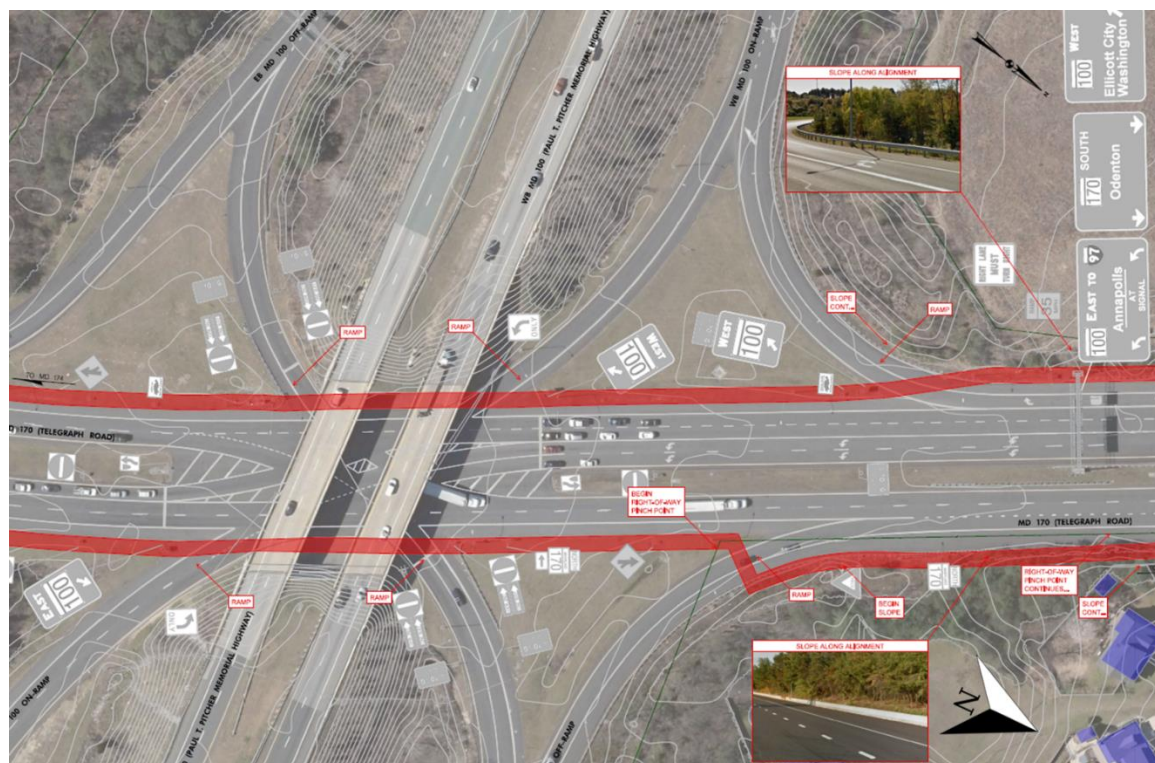


Figure 23: Telegraph Road at MD 100 interchange

Summary of Constraints/challenges along Telegraph Road

Table 3 provides a high-level summary of the barriers to trail construction and obstacles toward its usability – for both the east and west side:

Table 3: Summary of Barriers to Trail Construction along Telegraph Road

Barrier to Construction or Usability	East Side of Telegraph Rd	West Side of Telegraph Rd
Uncontrolled Crossings of interchange ramps	At MD 32, At MD 100	At MD 32, At MD 100
Uncontrolled crossings of high speed channelized right turns	At MD 175	At MD 175 At MD 174
Underpass Embankments	Presence of rip-rap embankment provides insufficient space for new trail.	N/A, sufficient room at MD 32 underpass for new trail.
ROW needs	Multiple Locations throughout the corridor	Multiple Locations throughout the corridor
Steep Side Slopes related to Open-Section roadway	Multiple Locations, north of MD 32	Multiple Locations, north of MD 32
Transmission Line poles	North of Odenton Rd	N/A
Buildings located in ROW	One commercial structure, north of Odenton Rd	N/A
Narrowed Roadway with over culvert or creek	Multiple Locations	Multiple Locations
Wetlands	Small area, south of Watts Ave	N/A
Forest Conservation Easement	N/A	N/A
Residential driveway crossings	Multiple locations, between MD 32 and MD 174	Multiple locations, between MD 32 and MD 174



As shown in Table 3, there are multiple barriers to constructing a safe comfortable trail along either side of the Telegraph Road corridor. Much of the corridor has narrow and discontinuous ROW widths that would require partial takes or easements. Similarly, there are several locations where the road traverses a creek or branch; at these locations, the roadway narrows such that any adjacent side path would require an additional parallel structure (e.g., a pedestrian bridge). Where the roadway narrows, there is often steep side slopes that lead to stormwater conveyance swales; these combined slopes/swales prevent the construction of side trails without the mitigating the SWM system, such as constructing inlets under the trail and enclosing the swales in pipes – effectively reconfiguring Telegraph Road from an open section drainage system to a closed-section one. Additionally, there are multiple residential driveways on both sides of the corridor; while these are not significant barriers to trail construction, each contributes an additional conflict point to trail users. More importantly, there are multiple interchange ramps and channelized right turns that would be uncontrolled high-speed trail crossings, unless these were signalized during trail construction. Finally, the east side of Telegraph Road has several unique obstacles not present on the west side. In addition to a small wetland area, just south of Watts Ave, there is also limited room underneath the MD 32 overpass, due to the steep riprap embankment that begins near the road edge – providing little room for sidewalk or trail construction under the overpass. Additionally, just north of Odenton Road, the east side of Telegraph Road has a commercial building within the ROW, near the abandoned railroad line, and a large regional transmission line pole that are both cost-prohibitive to relocate. A summary of constraints and potential mitigations is provided in the *Preferred Alternative* section of this report.

Trail Constraints along the WB&A Road Corridor

This section covers many of the major constraints toward implementing a buffered side trail on both the east and west side of WB&A Road, beginning at its southern termination. While WB&A Road has generous ROW width for a two-lane wide cross-section, there are multiple constraints that will require detailed design or compromising on the ideal typical trail cross-section.

Additionally, a primary difference between the WB&A Road and Telegraph Road is that WB&A Road was presumed to not require new curb and gutter to vertically separate a side path from the general-purpose travel lanes. This is due to the much lower speeds and vehicle volumes associated with WB&A Road. Appendix B shows all the constraints mapped comprehensively for the WB&A Road Corridor.

While WB&A Road is generally level on both sides of the road, as shown in Figure 24, there are periodic creeks and waterways where the roadway is constructed over a culvert and has guardrails on either side. In order for a side path to traverse the creeks, an additional parallel culvert must be constructed, or preferably a prefabricated pedestrian bridge can be placed adjacent to the roadway – spanning the creek.

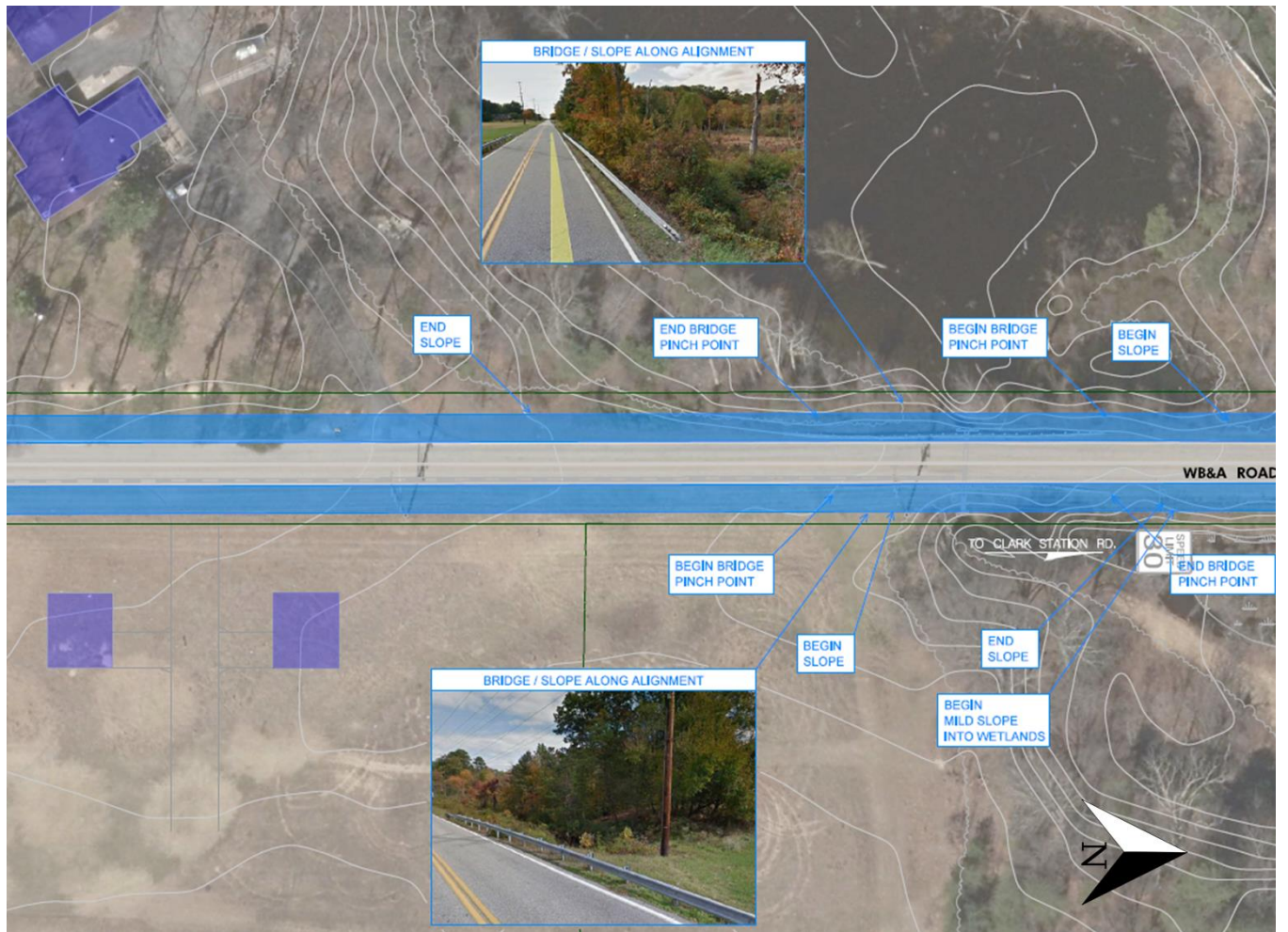


Figure 24: WB&A Road, south of Burns Crossing

Additionally, north of Burns Crossing Road there are occasional sloped sides along WB&A Road, as shown in Figure 26 that would require shallow-depth block retaining walls (Figure 25) in conjunction with re-grading to ensure that the path has a <2% lateral slope. Shallow-depth block retaining walls can be used up to height of 3 or 4 feet and are far cheaper to design and construct when compared to larger retaining structures that require borings, horizontal stabilizers, and footers.

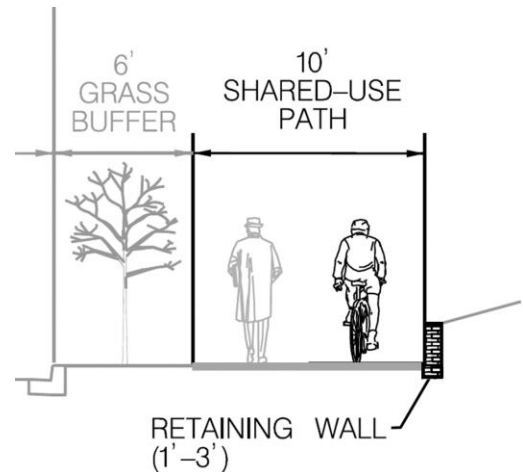


Figure 25: Example of a shallow-depth block-wall retaining wall



Figure 26: WB&A Road, north of Burns Crossing

North and south of MD 174, along the east side of WB&A Road, there are steep side slopes and adjacent parallel frontage roads. As shown in Figure 27, for example, there is a steep side slope between WB&A Road edge of pavement and the Delmont Road frontage road. This slope has a riparian area for drainage and guardrails and electricity transmission line poles – limiting the opportunities for placing trail within this sloped median. Any trail along the east side of WB&A Road would likely have to utilize this 2000-ft segment of Delmont Road, which runs from just north Lincoln Blvd to Thompson Ave.

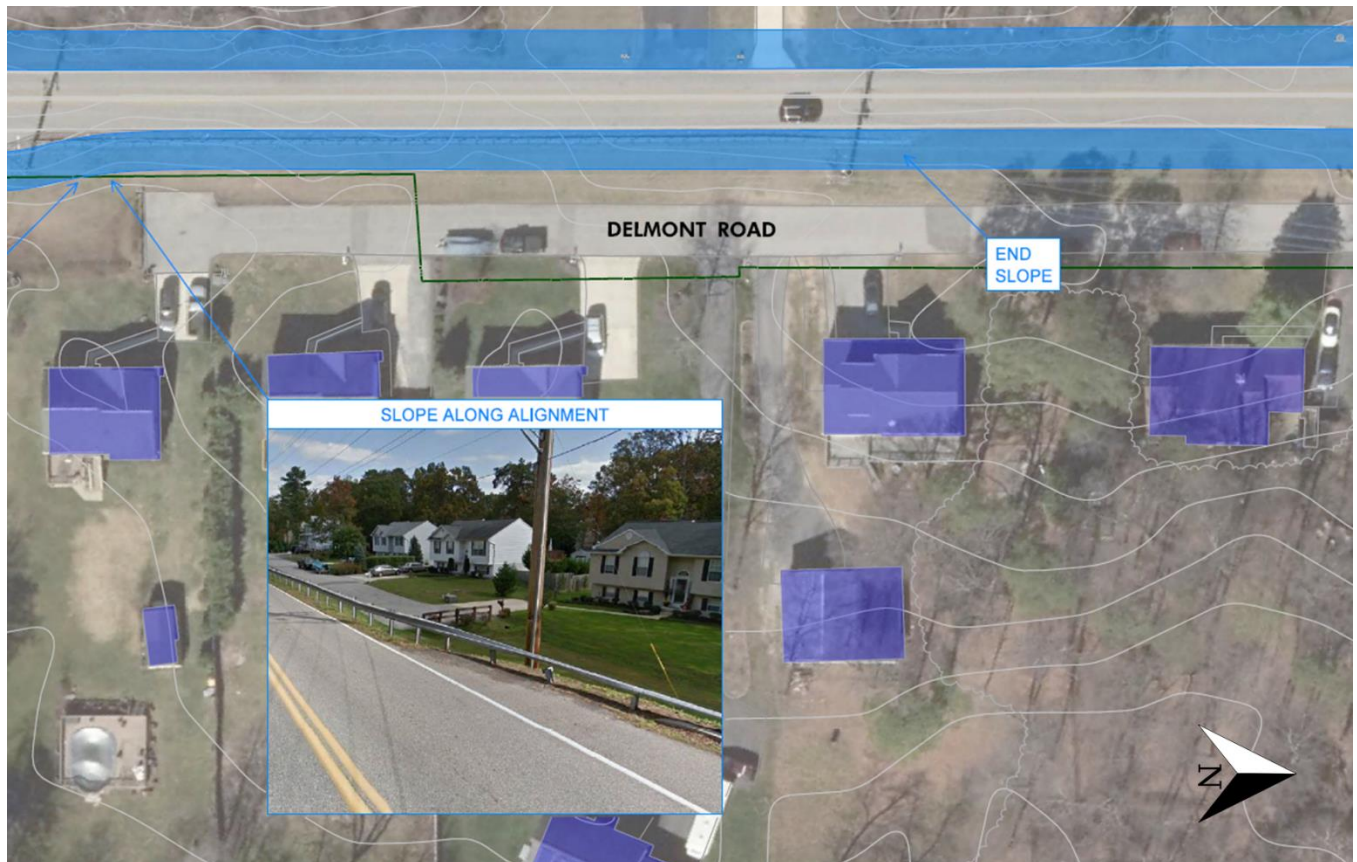


Figure 27: Delmont Rd frontage Road along the east side of WB&A Road

North of MD 174, there is a similar parallel frontage road – Redwood Tree Road – that is offset from WB&A Road with a steep-sloped grassy median that has guardrails, a riparian area, and electric transmission lines. Constructing a new trail would be cost-prohibitive along this 1000-ft median, located on the east side of WB&A Road, in between Sycamore Hill Rd and Evergreen Rd. An alternative would be to construct a short path from WB&A Road, down to Redwood Tree Road, which would then be utilized as a shared-use facility until the frontage road (and median) ends.



Figure 28: WB&A Road, north of MD 174

WB&A Road traverses MD 100 above grade and with no interchange ramps, providing a relatively safe crossing, as shown in Figure 29. However, the overpass bridge deck is only about 30 feet wide, consisting of two 11-ft lanes and two 4-ft shoulders. Assuming a side path along one side of the roadway, the two shoulders can be consolidated into a single 8-wide lane with vertical separation from the general-purpose travel lanes.

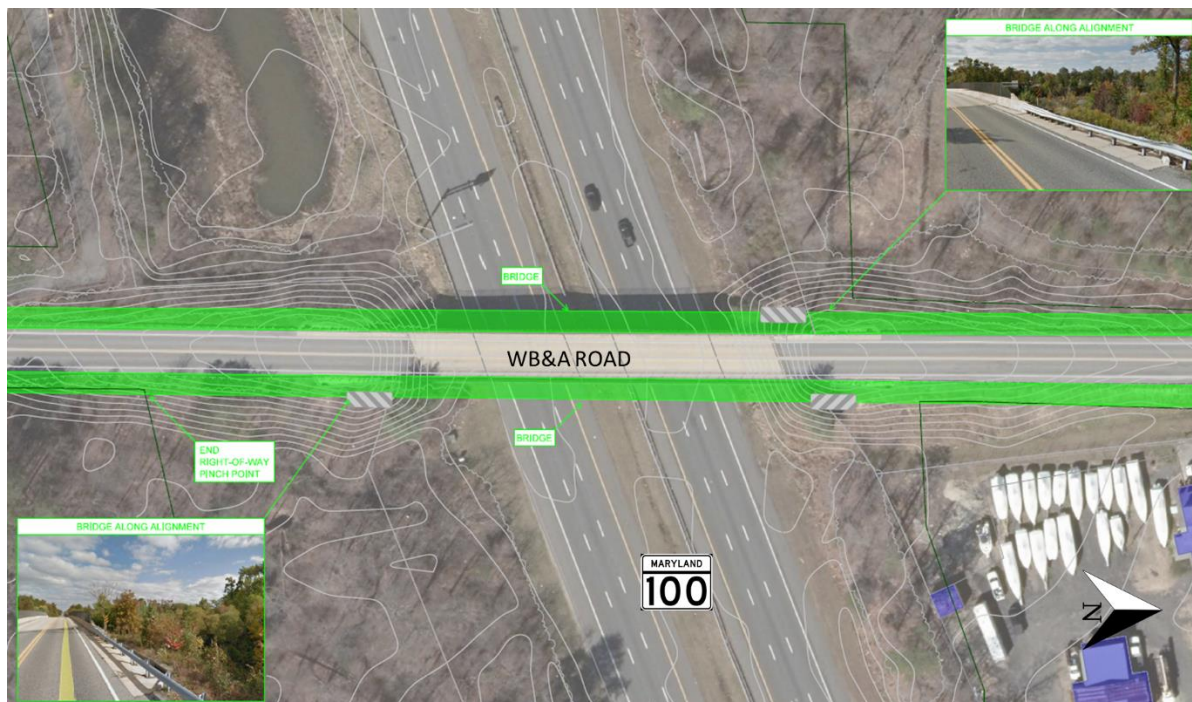


Figure 29: WB&A Road over MD 100

North of MD 100, prior to its termination at Dorsey Road, WB&A Road crosses Saw Mill Creek, where the road traverses a culvert underneath. As shown in Figure 30, the roadway over the culvert includes wide shoulders, each about 6-feet wide. By combining these shoulders and shifting the alignment of the



centerline, WB&A Road can be re-stripped for a dedicated side path without the construction of a new pedestrian/bike bridge over the creek.



Figure 30: WB&A Road, north of MD 100



Summary of specific Constraints/challenges along WB&A Road

Table 4 provides a high-level summary of the barriers to trail construction and obstacles toward its usability – for both the east and west side:

Table 4: Summary of Barriers to Trail Construction along WB&A Road

Barrier to Construction or Usability	East Side of WB&A Rd	West Side of WB&A Rd
Uncontrolled Crossings of interchange ramps	N/A	N/A
Uncontrolled crossings of high speed channelized right turns	N/A	N/A
Underpass Embankments	N/A	N/A
ROW needs	N/A	Potential ROW needs, depending on if shoulders are repurposed or grading can reduce/eliminate the need
Steep Side Slopes related to Open-Section roadway	Multiple Locations, related to drainage swale or culvert	Multiple Locations, related to drainage swale or culvert
Transmission Line poles	Poles can be designed around due to available ROW	Poles can be designed around due to available ROW
Buildings located in ROW	N/A	N/A
Narrowed Roadway with over culvert or creek	Multiple Locations	Multiple Locations
Wetlands	Small area, south of Watts Ave	Small area, south of Watts Ave
Forest Conservation Easement (typically not in public ROW; relevant only if extra ROW needed for grading, retaining walls, etc.)	All Locations outside of public ROW • South of Grand View Ave • South of MD 174 • South of Leyton Lane	All Locations outside of public ROW • South of Queenstown Rd • North of Chestnut Dr.
Residential driveway crossings	Multiple locations, from Old Mill Rd to MD 100	Multiple locations, from Old Mill Rd to MD 100

While the WB&A Road ROW is defined by the original railroad line and continues south of MD 32, the paved roadway itself terminates as a dead-end street north of MD 32, about 150 north of Old Mill Road. Generally, the WB&A Road public ROW is wide between 60 feet and 100 feet, providing ample room for a side path along a roadway that is only two lanes wide. There are areas that have varying degrees of side slope, due to the open-section nature of the roadway and drainage system. WB&A Road has a generally low volume – with about 4,000 daily vehicle per day in the northern portion, dropping down to only a few daily vehicles in the southern segment where it terminates. Additionally, there are no major interchange connection to MD 32 or to MD 100 and there are no channelized right turns at any intersections. Accordingly, as shown in Table 4, there are far fewer barriers to constructing a safe comfortable trail along either side of the WB&A Road corridor. Primary obstacles occur at culvert crossings the roadway narrows to approximately 22 feet with guard rails. At these locations the roadway and culvert can be widened, or, alternatively, a parallel adjacent pedestrian/bike bridge can be installed – since most culverts are short. Also, the bridge span over MD 100 is only 30 feet wide, requiring a restriping of the roadway that combines the bidirectional shoulders into a single two-way buffered/protected hiker/biker lane. Finally, similar to Telegraph Road, there are multiple residential driveways on both sides of the corridor; while these are not significant barriers to trail construction,

each contributes an additional conflict point to trail users. A summary of constraints and potential mitigations is provided in the *Preferred Alternative* section of this report.

c. Discussion of South Terminus Options

For the Telegraph Road alignment, only one southern terminus was identified – the intersection of Telegraph Road at Odenton Road, where the WB&A Trail currently ends in the north. This is a signalized intersection with crosswalks on all legs. As shown in Figure 31, the WB&A Trail ends at approximately Odenton Road, where a northside side path is present along Odenton Road and access to the Odenton MARC station is immediately to the west (via Becknel Ave). Figure 31 shows a potential new trail (in red) on both the east and west sides of Telegraph Road.

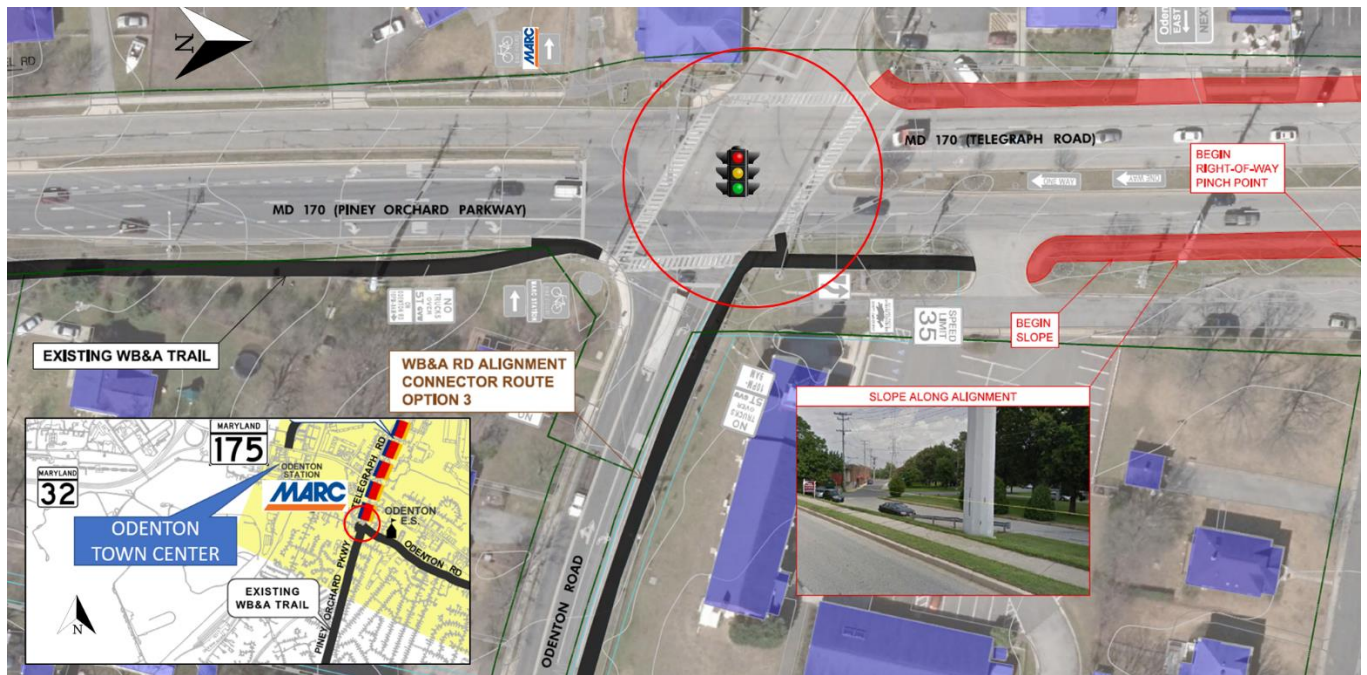


Figure 31: Southern Terminus of Telegraph Road alignment at Odenton Road / WB&A Trailhead

Several routes have been identified to complete the WB&A Road alignment in the south, joining WB&A Road to the WB&A Trail:

1. *Option 1:* Westward through the church parking lot to the MD 170 corridor
2. *Option 1a:* Southward through to Old Mill Road then westward to the MD 170 corridor
3. *Option 2:* Southward through Old Mill Road using WB&A Road ROW and County-owned land, under MD 32 culverts to Crossroads Drive, then westward to the MD 170 Corridor.
4. *Option 3:* Southward through to Old Mill Road then eastward toward Burns Crossing Road

These options will be discussed in detail below.

Option 1 and 1a

As shown in Figure 32, WB&A Road terminates in the south at a dead end, just north Old Mill Road. There is a vegetated declining slope from WB&A Road down to Old Mill Road. Both Old Mill Road and the adjacent church parking lot driveway can provide access to MD 170. Old Mill Road runs parallel to MD 32, about ¼ mile to the north. Option 1 utilizes the parking lot belonging to the Church at Severn



Run. The parking lot has driveways that connect it to both WB&A Road and to Telegraph Road. This route, while on private property, is often used by cyclists traveling north-south within the two corridors. Option 1a uses Old Mill Road to get from the end of WB&A Road to Telegraph Road, where a proposed trail would continue south to meet up with the WB&A Trail at Odenton Road. This option involves constructing a new path from WB&A Road to Old Mill Road, since the two roads do not intersect, as shown in Figure 32. Old Mill Road is low volume (~2000 AADT). This option proposes a side path along the north side of Old Mill Road, connecting WB&A Road with Telegraph Road.



Figure 32: Southern terminus of WB&A Road, north of Old Mill Road

Figure 33 shows Old Mill Road, looking west toward Telegraph Road near the Severn Run culvert crossing, just to the west of the WB&A Road ROW.



Figure 33: Old Mill Road, west of WB&A Road, looking west, heading over Severn Run creek

Option 2

Another option is to use a more direct path, through the culverts under MD 32 to avoid interchange ramps at the intersection of Telegraph Road (MD 170) / MD 32. The County owns the land and/or easement from the end of WB&A Road to Crossroads Drive. Figure 34 show a potential alignment for how a trail could be extended between the end of WB&A Road and the intersection of Telegraph Road at Crossroads Drive.



Figure 34: Concept utilizing County-owned land and the culvert under MD 32



Figure 35 shows the large culverts under MD 32 along with an adjacent easement leading to Crossroads Drive.



Figure 35: View of MD 32 Culverts looking north from an existing utility easement

Option 3

A final option identified for terminating the WB&A Road alignment to the south is via Old Mill Road *eastward* to Burns Crossing Road. This route follows Burns Crossing Road south to Sappington Station Road, where it ultimately meets the existing side path along Odenton Road at the Sappington Station roundabout. This route is the most circuitous but connects to many neighborhoods and also avoids uncontrolled interchange ramps. Additionally, an extension of the South Shore Trail is planned to connect with the existing Odenton Road side path at the Sappington roundabout. The following description and related figures show the conditions of this route option:

- Old Mill Road
 - Figure 36 shows Old Mill Road, looking west, between the WB&A Road ROW and Burns Crossing Road. The south side of the road has a branch of Severn Run, running along the side of it and protected with a guardrail. The north side has a slight uphill grade, but also some segments of the road that have sides swales for catching stormwater run-off.
- Burns Crossing Road
 - Figure 37 shows Burns Crossing Road, just south of Old Mill Road, looking south over the Severn run. The bridge deck over the culvert does not have sufficient width for a side trail or for separating pavement for a shared use path. In lieu of reconstructing the bridge, an adjacent side path and pedestrian bridge could be utilized to cross the Severn Run in this location.
 - Figure 38 shows another segment of Burns Crossing further to the south. No shoulders are present, and utilities are located close to the road edge. Any side path would need to be constructed behind the utilities to be cost-effective, however, this area is also used for collecting and conveying stormwater run-off.
 - Figure 39 shows a typical section of Burns Crossing that has 4 to 6' shoulders or turn lanes; this location is near the Millersville Landfill². In order to utilize only the existing

² Any alignment along Burns Crossing Road will need coordination with Millersville Landfill Facility Main Entrance Upgrades (Project N526947), currently in design.



pavement for a separated side path, all the shoulder width (or turn lane width) would need to be repurposed.

- Figure 40 shows the intersection of Sappington Station Road and Burns Crossing Road. No sidewalks, side path, or pedestrian crosswalks are present. Repurposing a new trail through this intersection may require the need for upgraded pedestrian signals and crosswalks. Burns Crossing Road has a 5,000 AADT between Sappington Station Road and Old Mill Road.
- Sappington Station Road
 - Figure 41 shows the Sappington Station Road overpass over MD 32. The bridge deck is 50 feet wide, as measured in the field, and serves 3 lanes. Accordingly, there is sufficient shoulder space on the deck to repurpose into a buffered and separated side path. Sappington Station Road has a 12,000 AADT at this location.
 - Figure 42 shows an existing side path along the west side of Sappington Station Road between the MD 32 overpass and the intersection roundabout with Odenton Road to the south.
- Odenton Road and existing northside side path
 - Figure 43 show the side path along Odenton Road, in between Telegraph Road (where the WB&A Trail terminates) and the Roundabout intersection with Sappington Station Road. Odenton Road has a 7,000 AADT.



Figure 36: Old Mill Road, looking west, with both uphill grades and with drainage areas



Figure 37: Burns Crossing Road, south of Old Mill Road has a narrow crossing over Severn Run



Figure 38: Burns Crossing has narrow road width in some places, with utility poles on each side



Figure 39: Shoulders/turn lane along Burns Crossing, by Millersville Landfill



Figure 40: Burns Crossing Rd at Sappington Station Rd looking South



Figure 41: Sappington Station Crossing over MD 32 heading towards Burns Crossing Rd



Figure 42: Side Path along Sappington Station Road looking north toward Burns Crossing Rd



Figure 43: Side path along Odenton Road from WB&A Trail to Sappington Circle

This option is less direct than options 1, 1a, or 2, needing approximately:

- 1200 feet of shared used path along Old Mill Road.
 - Requiring grading and tree clearing.
- 8400 feet of trail along Burns Crossing Road, using preformed curb to retrofit existing roadway.
 - Requiring a pedestrian bridge over Severn Run tributary.
- 1800 feet of separated trail along Sappington Station Road, using preformed curb to retrofit existing roadway.
- 200 feet of new shared use path along Odenton Road.
 - No grading or retaining structures needed.

Based on these dimensions and the trail typology above, a planning level estimate for constructing Option 3 is about \$800,000, as shown in Table 5.

Table 5: Option 3 Planning-Level Construction Cost Estimate

Element	Unit	Unit Cost	Units	Sub total
Pedestrian Bridge	Each	\$100,000	1	\$100,000
10' Trail (with grading and retainage)	Linear Feet	\$200	1,400	\$280,000
Preformed Curb (8' lengths at 15' spacing)	Linear Feet	\$25	10,200	\$255,000
Contingency @ 25% of subtotal	n/a	n/a	n/a	160,000
Total Cost				\$795,000



d. Discussion of North Terminus Options

Telegraph Road Northern Terminus

For the Telegraph Road alignment, only one potential termination point was identified – connecting to the BWI Trail via the intersection of Telegraph Road at MD 176, as shown in Figure 44. Other locations further east, along MD 176, were not considered for potential BWI Trail connections, because no signalized crossing is present for the next mile.



Figure 44: Northern Terminus of Telegraph Road alignment, ending at MD 176 (Dorsey Rd)

WB&A Road Northern Terminus Options

In the northern end of the WB&A Road alignment, there are two viable ways of providing a grade-separated crossing of MD 100 in order to subsequently end a trail at MD 176. As shown in Figure 45, the two options are: 1) continuing north along WB&A Road over the MD 100 overpass to the signalized intersection of MD 176 [Option 4]; and 2) Diverting westward along Queenstown Road [Option 5]. These options are shown in green and purple lines, respectively, in Figure 45. Option 4 provides for a continuation of the trail along WB&A Road, north of Queenstown, over MD 100 (Figure 46), prior to terminating at the BWI trail / signalized intersection with MD 176.

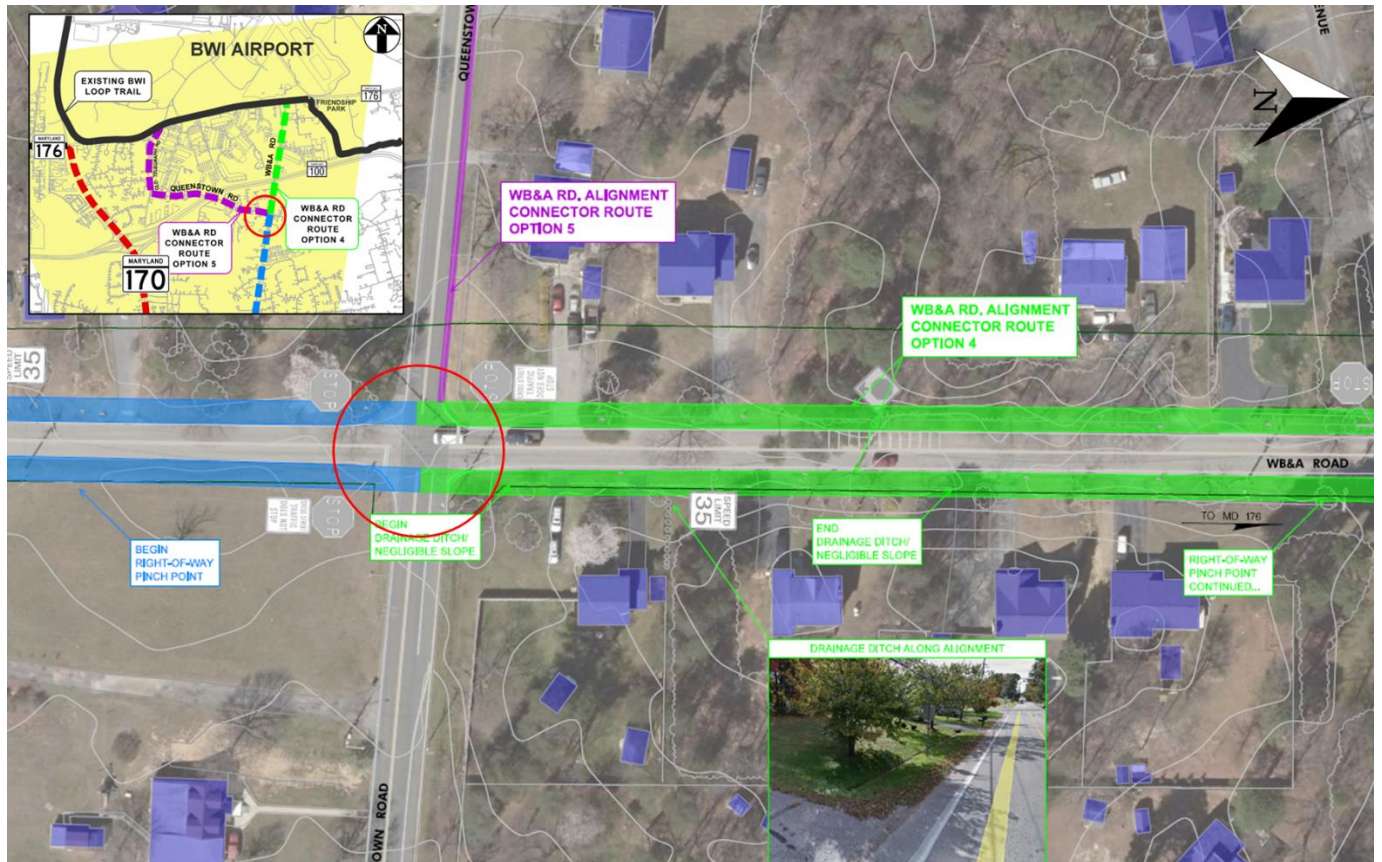


Figure 45: Optional Northern Termini along WB&A Road



Figure 46: WB&A Road overpass over MD 100

Option 5 terminates the WB&A Road alignment in the north via Queenstown Road (Figure 47), over MD 100 (Figure 48) to Old Telegraph Road (Figure 49), then north to its intersection with MD 176 (Figure 50).



Figure 47: Queenstown Road looking west toward Old Telegraph Rd



Figure 48: Queenstown Road overpass over MD 100



Figure 49: Old Telegraph, looking north toward MD 176



Figure 50: Intersection of Old Telegraph Road with MD 176

Of note, Old Telegraph Road does not have a direct connection to the BWI Trail, as its intersection with MD 176 is unsignalized. An additional side trail along the south side of MD 176 between Old Telegraph Road and Connelley Drive, would be required to provide controlled access for connecting to the BWI Trail.



5. Community Feedback on Alignments and Options for north/south Termini

a. Public Presentation and Survey

A virtual public outreach effort was held during September 2020. For about one month, the following items were hosted on the County's project website:

- Presentation of the project background and alignment options (PDF and video recording).
- Regional trail map with existing and planned trails and project study area.
- PDF of the proposed trail typical section minimum standards.
- PDF maps showing potential alignments for both Telegraph Road and WB&A Road corridors, as well as options for northern and southern termini.
- Link to an online survey and County Project Manager contact information.

The purpose of the presentation and online survey was to introduce the project to the public, show its role in the larger planned and existing regional trail network, and solicit feedback on the proposed alignments and options. Appendix C contains a copy of the public presentation.

Survey Results and Summary of Comments from Public Outreach

In addition to soliciting feedback on respondents' preferred alignment, the survey also delved into factors that potential trail users are looking for in determining the ideal alignment, as well as, general comments on where biking in the study area currently feels unsafe. In total, nine (9) questions were provided in the survey, with a total of 148 responders (though not all questions were answered by all responders). Additionally, several of the questions had options for additional comment. The nine questions, and a summary of responses, are shown below:

1. Do you have a preferred route?

- WB&A Rd
- MD 170
- Other/ No reference

The majority of respondents preferred the WB&A Road alignment over the Telegraph Road alignment, as shown in Figure 51. Where respondents preferred WB&A Road, the primary reason was that it was adjacent to less traffic and to slower traffic. Other top reasons provided included the ability to construct quicker and respondents living near the alignment, as well as its ability to allow for future network expansion.

Respondents in favor of the Telegraph Road alignment cited their living near the route and better access to local destinations as primary factors.

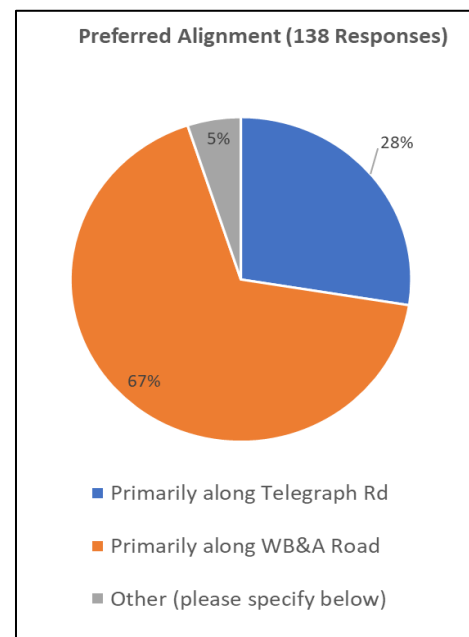


Figure 51: Surveyed Responses on Preferred Route



2. What factors are important to you in route selection? (multiple selections allowed)

- a. Avoids crossing highways/ramps
- b. Near natural/park areas
- c. Close to my home
- d. Quick construction
- e. Visible and not isolated
- f. Cost
- g. Near shopping/retail
- h. Near schools
- i. Other

When asked what factors are critical in route selection (and design), respondents primarily cited the need to avoid crossing highways and ramps. Accessing recreational facilities and being near their homes were also highly cited, as shown in Figure 52. Several “other” factors were cited, and these includes ability to connect to other trails, speed of construction, and having low vehicle volume adjacent to the trail.

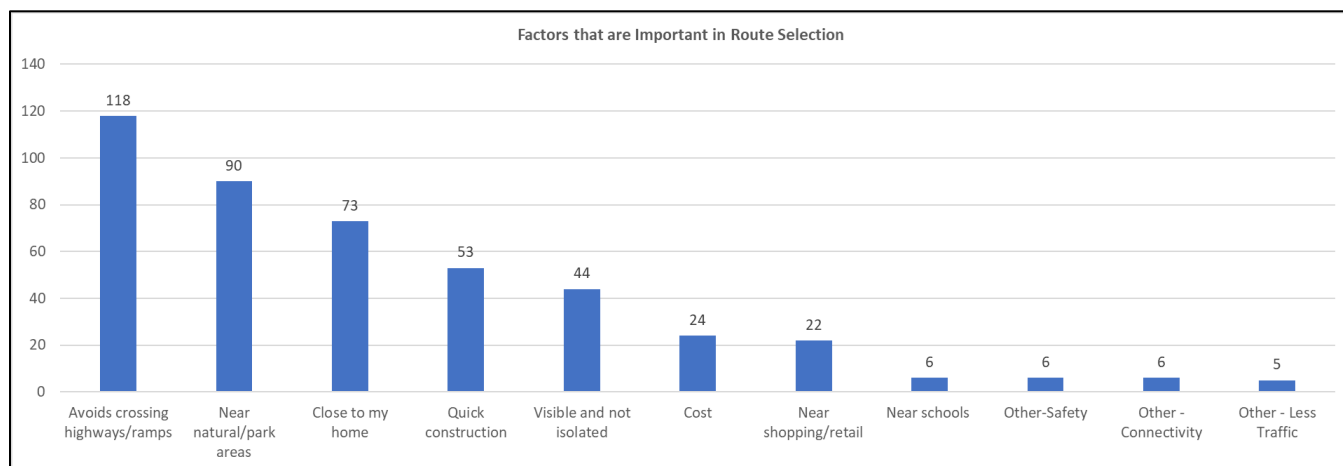


Figure 52: Survey respondents' factors cited for preferred alignment

3. How Often Would you use this path?

- a. Daily
- b. Once a week
- c. Monthly
- d. Never

When asked how often respondents would use the trail, about half said once a week, while 1/6th said *daily*, as shown in Figure 53.

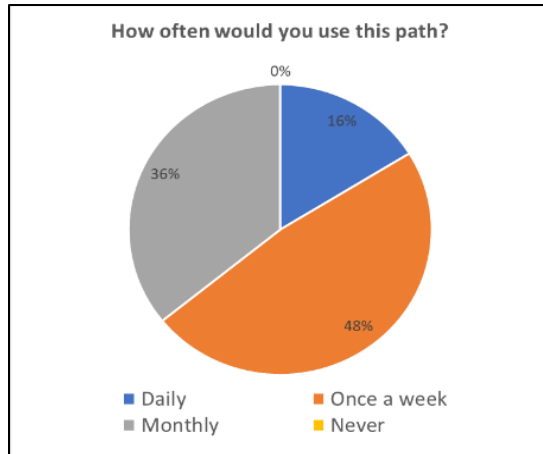


Figure 53: Expected Trail Use Frequency

4. For what would you use this path? (check all that apply)

- a. Recreation
- b. Retail / Business Trips
- c. Commuting
- d. Exercise
- e. Other

As shown in Figure 54, survey respondents cited recreation and exercise as the primary ways that they would use the trail. Other reasons included commuting and retail/commercial trips.

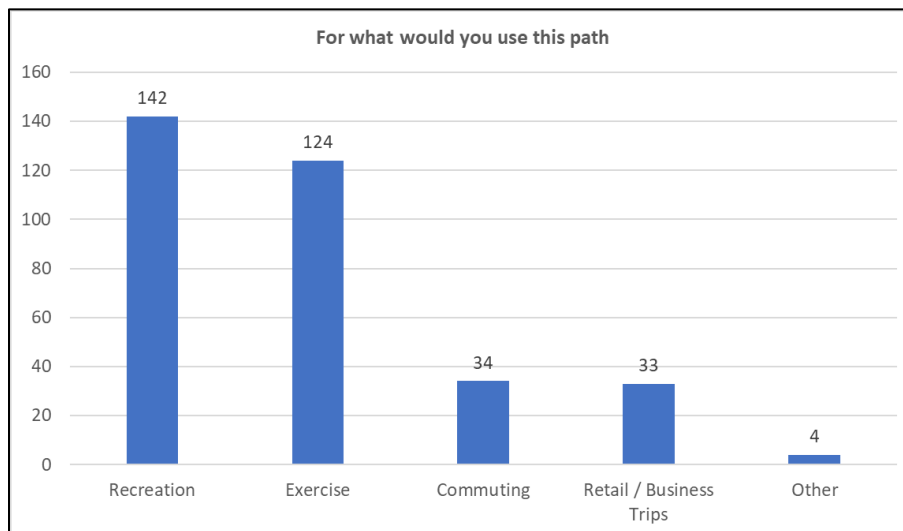


Figure 54: Expected uses of the trail by survey respondents

5. Do the existing and planned trails to the west of the study area influence your opinions on these alternatives?

As noted in the public outreach presentation and on the project website, several existing and planned trails are located to the west of the study area – primarily around MD 175 and Odenton Town Center. When survey respondents were asked if these trails impacted the preferred alignment, 72% said that these trails had no impact, while 23% replied that they did.



6. Do you have suggestion or concerns about either route that you would like to share with the County?

When asked about general comments regarding route selection, survey respondents replied that the paramount need is designing for safe cycling, as shown in Figure 55. Several other comments noted that the WB&A Road alignment is generally calmer than Telegraph Road. Additionally, there was a strong desire to see the alignment constructed quickly, as well as a preference for avoiding interchanges.

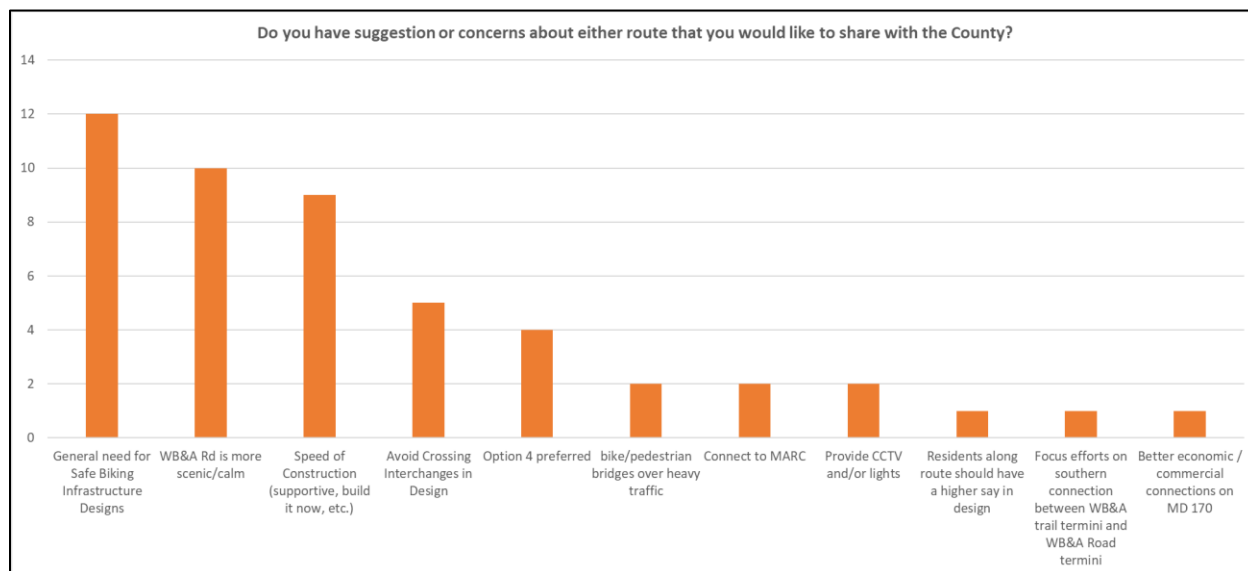


Figure 55: Survey respondents' answers regarding general comments on a desired alignment

7. Do you bike or walk for commuting or to travel to destinations such as school, shopping, or parks, now?

8. Do you bike recreationally now?

9. Do you walk recreationally now?

Finally, as shown in Figure 56, the survey polled current biking and walking habits. Of those that responded to the survey, about 2/3rd bike or walk to work, schools, parks, or shopping; and almost all bike or walk recreationally.

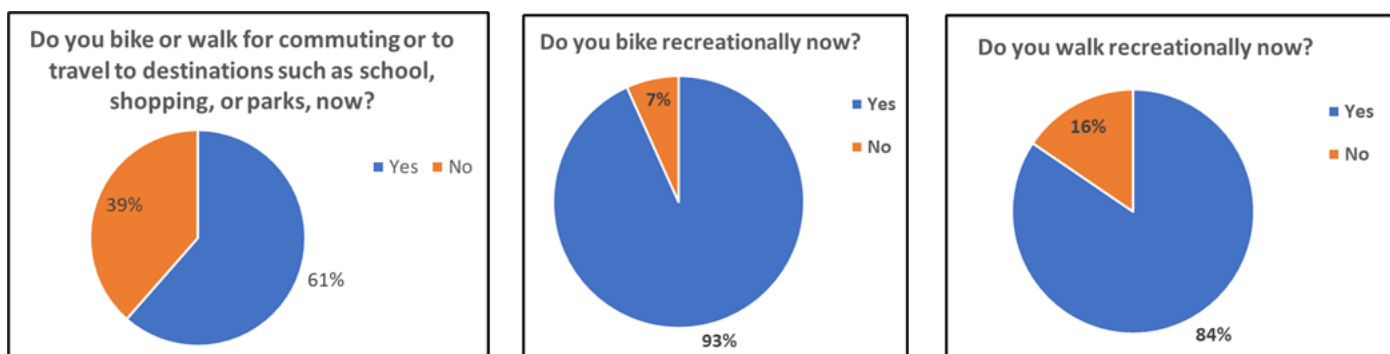


Figure 56: Survey Responses regarding current biking and walking frequency and purpose



Summary of Recommendations from Public Survey

Responses to the following queries were prioritized in applying public input and comments toward the preferred alignment selection:

1. The preferred route.
1. The factors important in route selection.
2. Frequency of expected path use.
3. Activity type expected by survey respondents.

Based on the responses to these questions, the following recommendations are made:

1. Utilize the WB&A Road right of way (ROW) for the preferred alignment.
2. Provide protected connections across major east/west roads.
3. Plan and design for future east-west “branches” from the WB&A Road Trail to provide needed connectivity to the Telegraph Road commercial corridor and to local amenities.
4. During the 35% design phase, buffer space between the path and WB&A Road is less critical as one travels southward from the BWI Trail, because the traffic volume along WB&A Road drops off considerably, allowing for greater flexibility of design within the available ROW. This allows for adjusting the trail as needed to avoid large tree roots or utility poles or other objects.
5. When terminating the trail to the north, utilizing the WB&A Road overpass over MD 100 is preferred when compared to option of using Queenstown Road to Old Telegraph Road.
 - a. The WB&A Road overpass has about 30’ feet of road width on the bridge over MD 100. During design, recommended lane widths could be 11’ for general north and south lanes and 8’ for a marked/painted path, with vertical separation devices on the bridge surface (e.g. pre-cast concrete curbs similar to the ones applied to Stoney Run Road overpass over MD 170/Aviation Blvd).
6. Evaluate the southern connection from the WB&A Road termini to the WB&A Trail termini for constructability, cost, right of way needs, and avoidance of interchange ramps.
 - a. Options 1, 2, and 3 all would ultimately provide connection to a planned South Shore Trail extension from Annapolis. All three would likely be expensive, because of the project length and/or because of the need for grade-separated crossings at MD 32 and its ramps.
 - b. Options 1 (either via the church parking lot or via Old Mill Rd) is a viable a direct (intuitive) option if the on/off ramps from MD 32 can be un-channelized and/or bridged and a path can be placed under MD 32 main line. Avoiding unsignalized ramps is highly preferred; as is avoiding being near high-speed traffic, in general.
 - c. Option 2, via the culvert under MD 32 doesn’t seem desirable, per public response.
 - d. Option 3 is a less direct connection, but it has no interchange ramp crossings and is more constructible than Option 2. It also provides direct trail access to more neighborhoods.
 - e. Given, multiple factors for southern termination, prioritize safety above all.
7. Ensure connection to the Odenton MARC Station, including additional signage and markings.

A more detailed summary, based on public comments, along with the raw survey results, can be found in Appendix D.



Additionally, Bicycle Advocates for Annapolis and Anne Arundel County (BikeAAA) weighed in the study with the following comments:

The completion of a shared-use trail from Odenton to BWI is a critical element of completing the Anne Arundel Trail Network as envisioned by Bicycle Advocates for Annapolis and Anne Arundel County and the Anne Arundel County Bicycle Advisory Commission. The network will provide safe biking and walking from numerous residential areas to schools, employment, recreation, transit and other destinations. This supports the goals of the approved Move Anne Arundel plan to shift mode away from single-occupancy vehicle travel to walking, biking and transit.

6. Alternatives Analysis and Preferred Alignment

a. Analysis of Alternatives

Multiple Factors were evaluated by the County in determining the preferred alignment, including:

- Public Input
- Safety and feasibility of overcoming safety challenges.
- Design / Constructability
- ROW Acquisition needs
- Environmental Impacts
- Construction Cost
- Connections to nearby destinations / neighborhood access

Public Input

When evaluating *public input*, there was a clear preference shown for the WB&A road alignment over the Telegraph Road alignment. Primary reasons cited were less traffic and smaller intersections. When asked about the primary design factors, respondents cited a need for safe facilities foremost, adding a need to avoid interchange ramps; desire for quick construction; and ability to connect to nearby destinations within the general study area.

Safety

When comparing the relative *safety* of each alignment, existing Level of Traffic Stress (LTS), side street and driveway crossings, and channelized ramp/right-turn crossings were evaluated. The LTS for Telegraph Road is a 4 on zero to 5 scale, indicating that the facility will likely be unusable to all but the most confident road cyclists. By comparison, the LTS for WB&A Road is 3, indicating that more users would feel comfortable riding along it. When evaluating the northern terminus options (Queenstown Road option versus WB&A Road option), the former has an LTS of 2 and the latter an LTS of 3, indicative of the very low volumes along Queenstown Road (~2000 vehicles per day). While the proposed buffered trail connection from Odenton to BWI is expected to have an LTS 0, when completed, the southern terminus options (for WB&A Road alignment only) currently have the following existing LTS:

- *Option 1, Church Parking Lot:* LTS 1
- *Option 1a, Old Mill Road:* LTS 3 on-road only
- *Option 2, Under MD 32 thru drainage culverts:* LTS 1
- *Option 3, Burns Crossing Rd to Sappington Station Rd to Odenton Rd:* Variable LTS between 1 and 4



The number of driveway and side street crossings was also evaluated for each side of each alignment. While driveways and minor side streets crossings are not inherently dangerous to cyclists, they do contribute additional potential conflict points. Additionally, the number of interchange ramps and uncontrolled channelized right turn crossings was evaluated for comparing alignments, as summarized in Table 6.

Table 6: Evaluation of trail conflict points

Roadway		No. of Driveways	No. Major Side Streets	No. Minor Side Streets	No. of Interchange Ramp and Channelized Right Turn Crossings
Telegraph Road	East Side	33	2	14	10
	West Side	35	2	18	10
WB&A Road	East Side	83			0
	West Side	85			0
South Terminus, Option 1: Church Parking Lot	East Side	0	0	0	0
	West Side	0	0	0	0
South Terminus, Option 1a: Old Mill Road to Telegraph Road	North Side	0	0	0	1
	South Side	0	0	1	0
South Terminus, Option 2: under MD 32 culverts	East Side	0	0	1	1
	West Side	0	0	1	1
South Terminus, Option 3: Burns Crossing Rd to Sappington Station Rd	East Side	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
	North/West Sides	6	0	10	0
North Terminus, Option 4: Continue WB&A Rd to MD 176	East Side	8	0	1	0
	West Side	3	0	1	0
North Terminus, Option 5: Queenstown Rd to MD 176	East Side	31	0	1	0
	West Side	29	0	0	0

Table 6 shows that there are more driveways along the WB&A Road corridor, but the Telegraph Road corridor has more interchange ramps and uncontrolled channelized right turn crossings, which represent significantly higher-speed conflict points.

Additionally, Telegraph Road has an annual average daily vehicle traffic volume of up between 20,000 and 30,000 vehicles per day, while WB&A Road sees between 100 and 4,000 vehicles per day, depending on the road segment.

Design / Constructability

The ideal terrain for constructing a side path along a roadway would be flat, behind an existing curb, and with no utilities/structures in the way, as this would minimize both design and construction costs. Accordingly, when evaluating each side of each alignment, as well north/south terminating options, for constructability, the following critical factors were evaluated:

- The need to relocate above-ground utilities
 - If there was ample ROW available to bend a trail around a utility pole, then it was not counted as an impacting factor
- The need to construct footer-supported retaining walls, due to steep slopes



- Footer-supported retaining walls are below the frost line, often have stabilizers, require detailed design, and are taller and substantially more expensive than shallow depth block-wall retaining walls. Block-wall retaining structures don't require a footer, are usually no higher than 3 feet, and are constructed in conjunction with minor grading. Accordingly, only footer-supported retaining walls are tabulated as critical design factors.
- Need for installing pedestrian bridges over waterways, due to narrow culvert crossings
 - Areas where a roadway narrows and spans a creek/culvert box, it was assumed that any side path would cross a creek using a new adjacent parallel prefab pedestrian bridge, as opposed to reconstructing a widened road and culvert to carry the side path.

These factors were tabulated for each side of each corridor as shown in Table 7.

Table 7: Constructability Issues for each alignment

Roadway		Pedestrian/Bike Bridge Spans	Footer-supported Retaining Walls (ft)	Utility Poles Relocated
Telegraph Road	East Side	1	1600	127
	West Side	1	2000	130
WB&A Road	East Side	1	0	0
	West Side	1	0	0
South Terminus, Option 1: Church Parking Lot	East Side	0	0	0
	West Side	0	0	0
South Terminus, Option 1a: Old Mill Road to Telegraph Road	North Side	0	0	0
	South Side	0	0	0
South Terminus, Option 2: under MD 32 culverts	East Side	500' boardwalk	0	0
	West Side	500' boardwalk	0	0
South Terminus, Option 3: Burns Crossing Rd to Sappington Station Rd	East Side	Not Evaluated	Not Evaluated	Not Evaluated
	North/West Sides	0	0	0
North Terminus, Option 4: Continue WB&A Rd to MD 176	East Side	0	0	0
	West Side	0	0	0
North Terminus, Option 5: Queenstown Rd to MD 176	East Side	0	0	14
	West Side	0	0	14

Table 7 shows varying structural requirements that would impact the construction of a side path within each corridor. While both would require a pedestrian bridge, WB&A Road's ample ROW allows for a side path to be constructed without the need for utility pole relocation or retaining walls. Telegraph has steeper side slopes and narrow ROW, requiring taller footer-supported retaining walls. However, option 5, that terminates the WB&A Road alignment via Queenstown Road, *would* require about 14 pole relocations due to limited ROW.

ROW Acquisition needs

Right of (ROW) is noncontiguous along both corridors, with variable widths. WB&A road ROW was established when the alignment was a former rail line and is generally much wider than the current two-lane cross section of the roadbed. Telegraph Road ROW is generally closer to the road or sidewalk edge – often with the less than 8 feet of extra public property available for infrastructure expansion. The 14-



ft minimum typical section (10' trail and 4' buffer) was overlaid over existing ROW boundaries in order to determine the number of private property takes (e.g. narrow *strip* takes) that were needed to have the trail entirely within public property. Table 8 summarizes these takes.

Table 8: Summary of ROW needs for each alignment

Roadway		ROW Needs (No. Parcels for strip takes)
Telegraph Road	East Side	45
	West Side	12
WB&A Road	East Side	0
	West Side	5
South Terminus, Option 1: Church Parking Lot	East Side	0
	West Side	0
South Terminus, Option 1a: Old Mill Road to Telegraph Road	North Side	2
	South Side	2
South Terminus, Option 2: under MD 32 culverts	East Side	0
	West Side	0
South Terminus, Option 3: Burns Crossing Rd to Sappington Station Rd	East Side	16
	North/West Sides	11
North Terminus, Option 4: Continue WB&A Rd to MD 176	East Side	0
	West Side	0
North Terminus, Option 5: Queenstown Rd to MD 176	East Side	27
	West Side	29

As shown in Table 8, the WB&A Road alignment requires only a few private property strip takes on the west side and zero on the east side. When terminating in the north, the alignment option that utilizes Queenstown Road has several ROW takes required, the option that remain on WB&A Road requires none. For Telegraph Road alignment, the east side requires about 45 parcel strip takes on the east side, and only 12 takes on the west side.

Environmental Impacts

When evaluating environmental impacts, the following criteria were tabulated:

- Presence of a floodplain through the proposed trail alignment
- Presence of wetlands through the proposed trail alignment
- General tree loss



Table 9 show a comparison of these impacts for each alignment of terminus option

Table 9: Comparison of some Environmental Impacts

Roadway		Alignment in Flood Plain?	Alignment in Wetlands?	Tree Loss
Telegraph Road	East Side	Yes – short segment over Severn Run tributary	Yes – short segment	~70 street trees
	West Side	Yes – short segment over Severn Run tributary	Yes – short segment	~45 street trees
WB&A Road	East Side	Yes – short segments over Severn Run tributary and Saw Mill Creek	Yes – short segment	0 to 5 trees, depending on alignment
	West Side	Yes – short segments over Severn Run tributary and Saw Mill Creek	Yes – short segment	0 to 5 trees, depending on alignment
South Terminus, Option 1: Church Parking Lot	East Side	no	No	0
	West Side	no	no	0
South Terminus, Option 1a: Old Mill Road to Telegraph Road	North Side	yes	No	5 to 10 trees
	South Side	yes	No	5 to 10 trees
South Terminus, Option 2: under MD 32 culverts	East Side	Yes – most of segment	Yes – most of segment	5 to 10 trees
	West Side	Yes – most of segment		5 to 10 trees
South Terminus, Option 3: Burns Crossing Rd to Sappington Station Rd	East/south Side	Yes	Yes – south side of Old Mill Road	~30 trees along Old Mill Road
	North/West Sides	Yes	no	~25 trees along Old Mill Road
North Terminus, Option 4: Continue WB&A Rd to MD 176	East Side	No	No	0 to 5 trees, depending on alignment
	West Side	No	No	0 to 5 trees, depending on alignment
North Terminus, Option 5: Queenstown Rd to MD 176	East Side	No	No	0 to 5 trees, depending on alignment
	West Side	No	No	0 to 5 trees, depending on alignment

As shown in Table 9, there is generally minimal tree loss for each alignment. However, removal of any public ROW tree will require a Maryland Roadside Tree Permit, and the ultimate design will attempt to



preserve all Specimen trees and forested land, if possible. During the 30% Design phase, additional planting areas will be identified if tree clearing occurs near residential areas. While there are no expected Forest Conservation impacts, because this project is considered a linear project, it is expected to be exempt from Forest Conservation requirements provided that less than 20,000 square feet of clearing occurs outside of the public right-of-way. Finally, wetlands and floodplain impacts arise at only select tributary/creek crossings. However, an MDE/Army Corps permit will be required if disturbance will occur within the Severn Run stream at the crossing near Old Mill Rd.

Construction Cost

As discussed previously, the ideal construction of side path would entail no grading, retaining walls, pedestrian bridges, or utility relocation and have ample ROW. Even under these ideal conditions, the side path will cost several million dollars based solely on its 6+ mile length. While a detailed cost estimate was not conducted for each alignment and option during the alternatives analysis, a *relative* cost – compared to the ideal construction – was developed, with each alignment broken into smaller segments and a *high, low, medium* descriptor was applied for each segment to see how the two primary alignments compare to each other. Relative costs are related to additional ROW needs, structural needs, and utility relocation. The relative cost for each alignment is shown in Table 10.

Table 10: Relative Costs of Alignment

Roadway		Relative Cost
Telegraph Road	East Side	HIGH
	West Side	HIGH
WB&A Road	East Side	MEDIUM
	West Side	MEDIUM
South Terminus, Option 1: Church Parking Lot	East Side	LOW
	West Side	LOW
South Terminus, Option 1a: Old Mill Road to Telegraph Road	North Side	MEDIUM
	South Side	HIGH
South Terminus, Option 2: under MD 32 culverts	East Side	HIGH
	West Side	HIGH
South Terminus, Option 3: Burns Crossing Rd to Sappington Station Rd	East/south Side	MEDIUM
	North/West Sides	MEDIUM
North Terminus, Option 4: Continue WB&A Rd to MD 176	East Side	MEDIUM
	West Side	MEDIUM
North Terminus, Option 5: Queenstown Rd to MD 176	East Side	HIGH
	West Side	HIGH

As shown in Table 10, Telegraph Road has a higher expected cost than WB&A Road – due largely to the additional ROW needs and required retaining structures. A detailed cost estimate of the preferred option is discussed later in the *Preferred Alignment and Description* section of this report.



Connections to nearby destinations / neighborhood access

Finally, an additional factor evaluated was the ability to connect to existing and planned east-west connections, local destinations (parks, institutions, retail, etc.), and adjacent neighborhoods.

In the southern end of the of the study, both primary alignments will provide connects to the WB&A Trail and the Odenton MARC Station – and by extension, Odenton Town Center. Additionally, both alignments end at Odenton Road, which has a side path heading east toward Sappington Station Circle, where the planned South Shore Trail extension will terminate. In the north, both primary alignments terminate at the BWI Trail.

The Telegraph Road alignment provides more direct commercial access, however, the WB&A Road southern options 1 and 1a provide the same access. Both alignments provide access to Severn-Danza Park, via MD 174, while only the WB&A Road alignment provides access to the smaller local Queenstown Park. The option 2 southern alignment under MD 32 does not provide additional neighborhood access compared to options 1 or 1a; however, option 3 allows the proposed alignment to reach other neighborhoods in the east side of the study area. Option 3 is less direct than either of the other southern options.

A more detailed matrix summarizing and comparing the impacts of each alignment and terminating option can be found in Appendix E.

b. Preferred Alignment and Description

When evaluating the benefits and disadvantages of both the corridors, as well as each *side* of both corridors, the County placed the highest weight on a design for safety, with the understanding that the design will be expensive irrespective of constructability issues. Specifically, the number of interchange crossings played a critical role in the corridor selection, while the number of driveway and side street crossings played a role in the side (east or west) of the preferred alignment – with the understanding that the trail should not weave from east to west repeatedly to avoid a costly retrofit or utility relocation. Additionally, the County evaluated each corridor's ability to incorporate future east-west connections to key destinations such as: Severn-Danza Park, the commercial areas along MD 170 and other key points of interest. Finally, public preference played major role in choosing the preferred corridor.

After weighing all the evaluated factors, the preferred alignment is a new buffered side path along the east side of WB&A Road, with the northern end terminating at the intersection of WB&A Road at MD 176 (Dorsey Rd) and the southern terminus consisting of a new side path from WB&A Road to the North Side of Old Mill Road, then traversing the east side of Telegraph Road and then south to MD 32, where the side path transitions to the west side of Telegraph – ending at the Trailhead for the WB&A Trail at Odenton Road. A 10% Drawing plan set of this preferred alignment is show in Appendix F. The remainder of this report section will discuss some of the details of the design and highlight critical areas of the alignment that will need further exploration during the next design phase.

The proposed alignment terminates at the northwest quadrant of Telegraph Road at Odenton Road, as shown in Figure 57. The intersection is fully signalized and push-button activated pedestrian signals and crosswalks on four legs. The intersection provides direct access to both the MARC station (and to Odenton Town Center) and also the WB&A Trail.

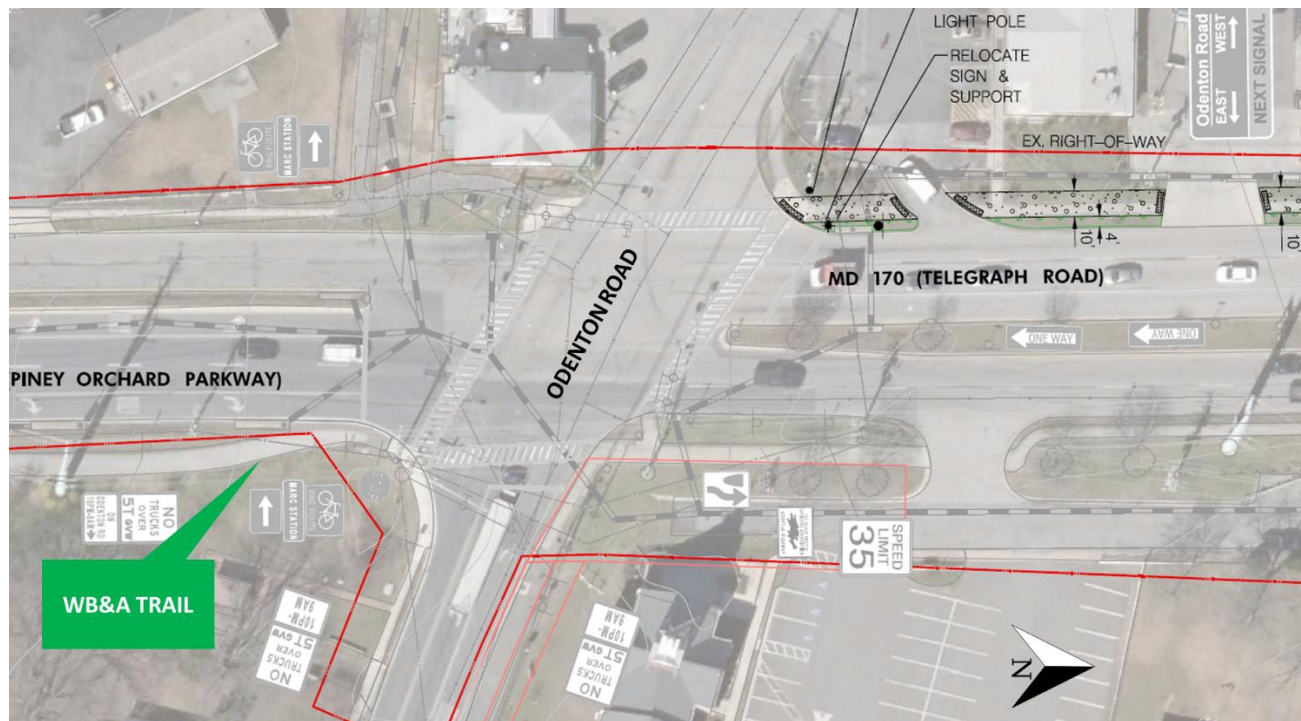


Figure 57: Preferred Alignment southern terminus and connection to the WB&A Trail

The preferred alignment will continue northward along the west side of the Telegraph Road as a buffered 10-foot trail, crossing MD 175 as shown in Figure 58. As illustrated, the trail crosses the existing channelized right turns to/from MD 175 as uncontrolled crossings. It is highly recommended that the right turn crossings are signalized or that the channelization is removed via geometric improvements to the intersection. Additionally, the main crossing MD 175 will need a pedestrian signal phase concurrent with the existing southbound Telegraph Road movement/phase³. Finally, the southwest quadrant has steep slopes that will require regrading, some retaining structures, and a handrail.

³ The signal phasing is split north-south, meaning that during the southbound vehicle movement, pedestrians and cyclists can traverse the west side crosswalk across the MD 175 mainline in a fully protected manner, because all northbound left traffic has a red signal.

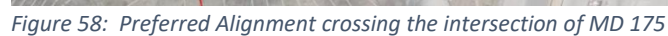
[illegible]

Figure 59: Preferred Alignment through the MD 32 interchange

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⁵ Recent traffic counts show about 200 peak hour vehicles for both the left and right turn movements; these volumes can be accommodated with a single lane for each with only minor signal timing adjustments.



As shown in Figure 61, there is ample ROW along both sides of WB&A Road, and the buffered side path is shown along the east side. However, given that the block south of George Ave is a dead-end with only 4 houses on it – some of which are sited close to the roadway, this block would function much the same as roadway marked and signed for sharing (e.g., sharrow markings and “share the road” signage), without the trail shown in Figure 61.



Figure 61: Preferred Alignment along the southernmost block of WB&A Road

Just south of Burns Crossing Road, WB&A Road narrows and traverses a culvert over a Severn Run tributary. At this location there are guardrails along each side of the road. Instead of widening the culvert and roadway, the preferred alternative proposes a parallel pedestrian prefab bridge ~50 feet long to carry the trail across the tributary (as shown in Figure 62) without impacting it ore reconstructing the road.

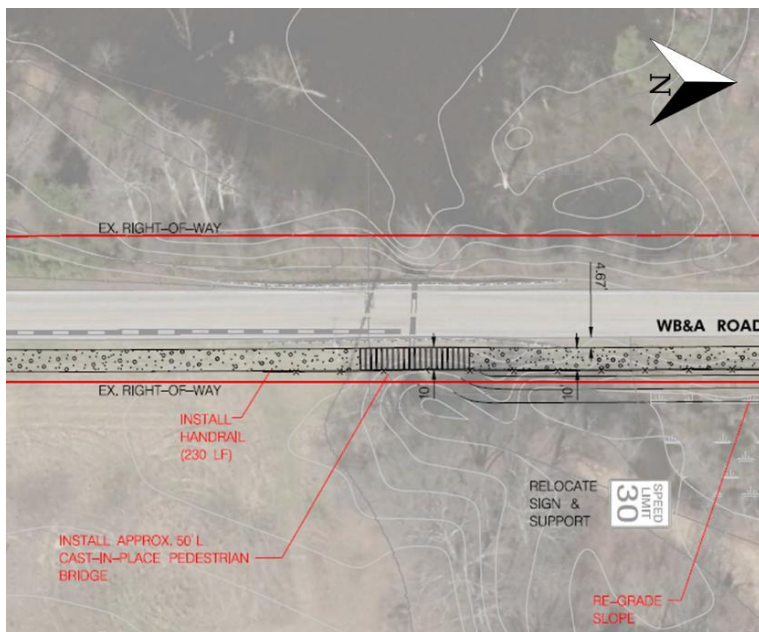


Figure 62: Preferred Alignment & creek crossing along WB&A Road, south of Burns Crossing Rd



At the all-way stop-controlled intersection of WB&A Road at Burns Mill crossing the trail is recommended to continue along the east side of the roadway, where minor curb and gutter improvements are recommended at the northeast corner in order to provide some buffer between the trail and the roadway and provide some addition vertical separation. See Figure 63.

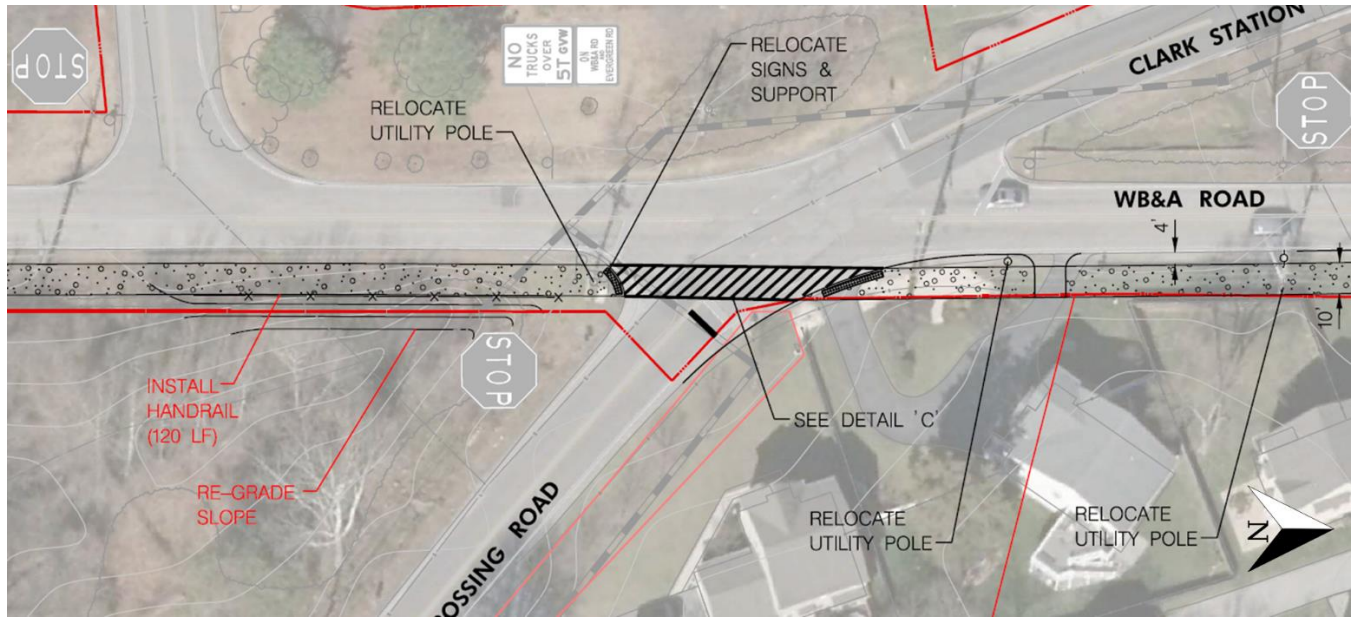


Figure 63: Preferred Alignment at the intersection of WB&A Road at Burns Crossing Road

North of Governor Johnson Blvd, WB&A Road has steep slopes on both side of the roadway. While these can be mitigated with a footer-based retaining wall, the preferred alignment recommends using the Delmont Road frontage road and sharing this with pedestrians and vehicles. Delmont road is a dead-end street serving about a dozen houses, making it a very low volume roadway. The preferred alignment shows the side path sloping down to meet with the Delmont Road turn-around, as shown in Figure 64. The frontage road ends approximately 2000 feet to the north at Thompson Ave.

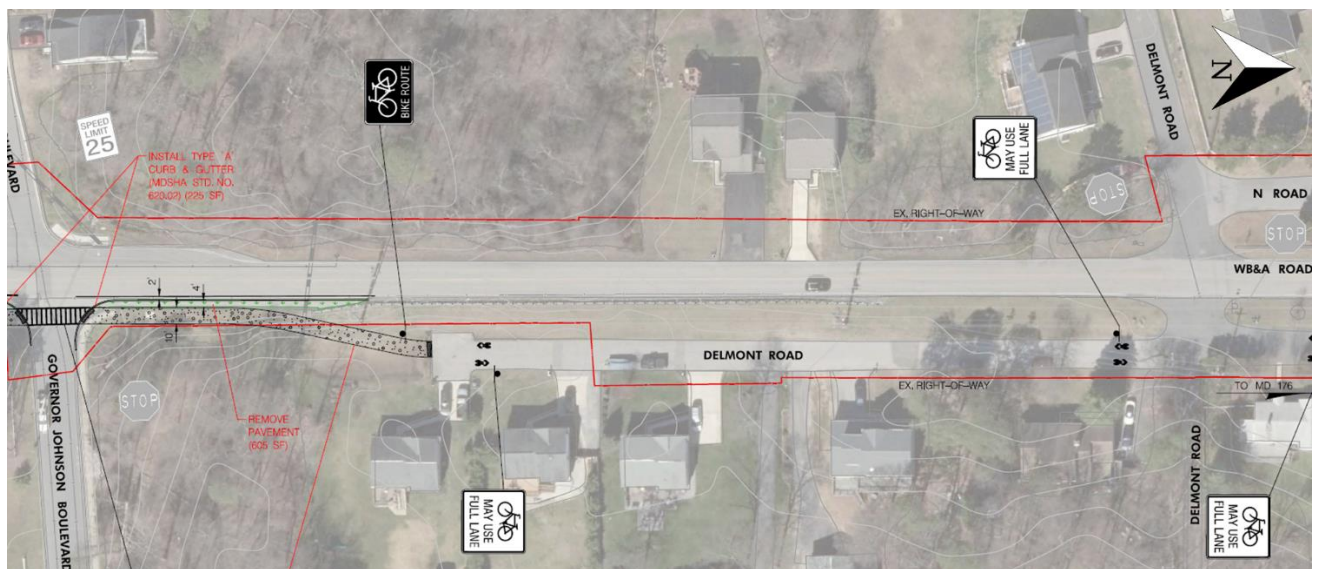


Figure 64: Preferred alignment along WB&A Road north of Governor Johnson Blvd



Donaldson Avenue (MD 174) at WB&A Road also presented a unique challenge along the proposed trail alignment as the only signalized crossing. Donaldson Avenue is a two-lane state highway with a speed limit of 45-mph. As shown in Figure 65, the intersection of WB&A Road at Donaldson Avenue has exclusive right turn lanes on northbound and southbound WB&A Road and exclusive left turn lanes on eastbound and westbound Donaldson Avenue. Left turn movements on Donaldson Avenue operate under exclusive / permissive left turn signal phasing.

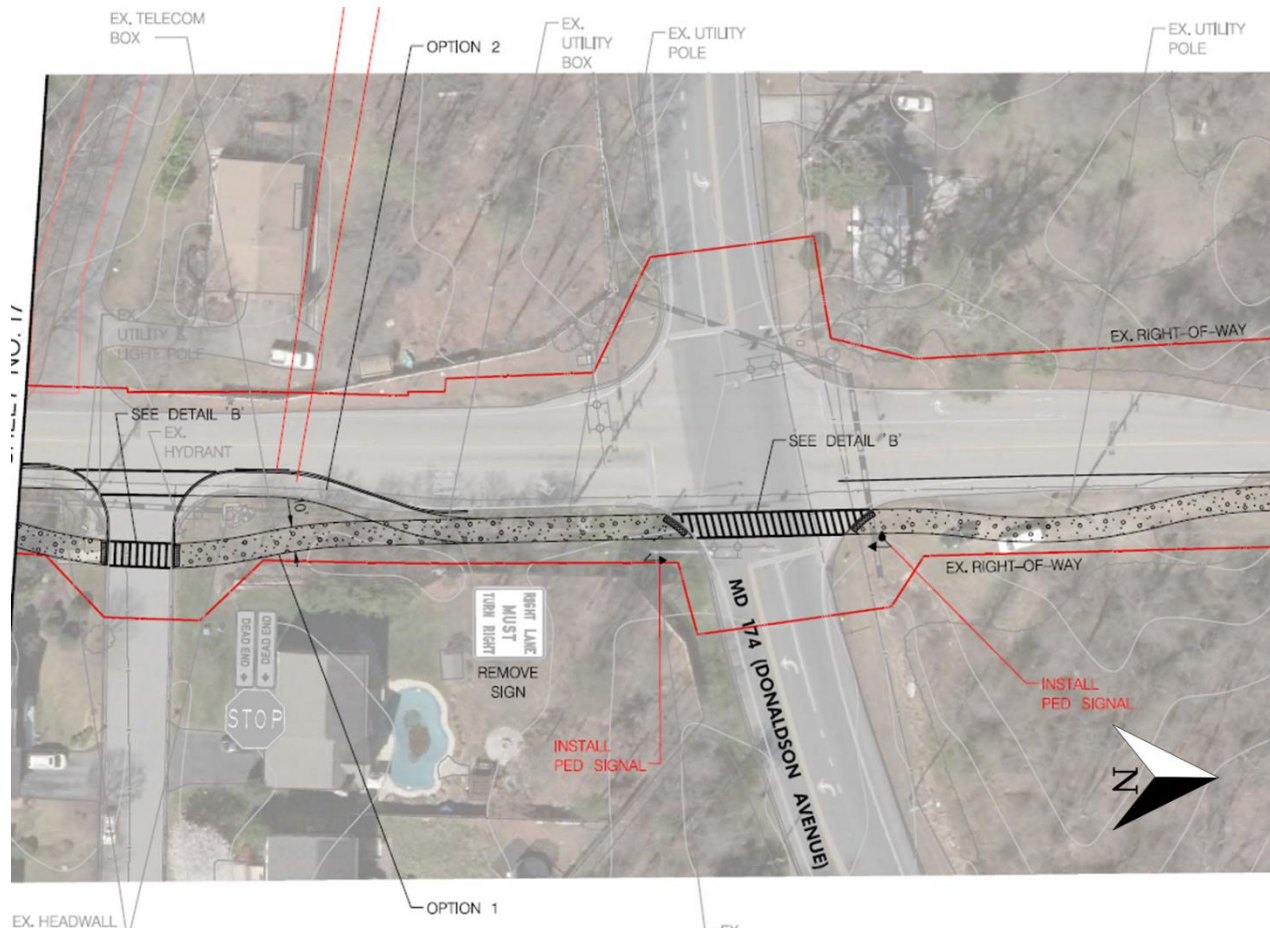


Figure 65: Preferred Alignment at the intersection of WB&A Rd at MD 174

Crossing treatment recommendations at WB&A Road and Donaldson Avenue include installation of pedestrian signals and pavement markings, lane consolidation, and signal modifications to enhance pedestrian and cyclist safety:

- At a minimum, the proposed alignment recommends installation of accessible pedestrian actuated signals (APS) and high-visibility crosswalks should be installed to establish trail movements at the intersection.
 - Additionally, signal timing and phasing should be modified to ensure adequate pedestrian crossing times and cycle lengths should be reviewed and reduced where possible to minimize trail delays.
 - Leading Pedestrian Intervals (LPI) of 3 to 5 seconds should be provided to allow trail users to establish themselves within the crosswalk prior to the green indication for concurrent permissive vehicular movements.



- Right Turn on Red prohibition signage is recommended to restrict right turn on red movements from the westbound Donaldson Avenue approach to reduce the number of trail conflict points.
- Northbound through and right turn only lanes on the south leg of WB&A Road are recommended for consolidation in order to interrupt and slow the flow of northbound right turn movements across the trail crossing.

Additionally, the proposed design allows for a future east-west trail connection. About 20 feet of ROW exists beyond the pavement edge along the north side of MD 174 for a future east-west side path to ultimately provide direct connection between the proposed WB&A Road trail and Severn-Danza regional park.

Finally, as shown in Figure 65, two options are presented for the trail alignment as it approaches MD 174 from the south. While both are in the public ROW, Option 1 places the trail behind the existing edge of pavement, while option 2 replaces existing paved shoulder with a buffered trail. While Option 1 is highlighted, exploring Option 2 is recommended, as it has the advantage of being less expensive and less intrusive to adjacent drainage systems and landscaping, while providing no net increase in impervious surface.

As shown in Figure 66, a short 700-ft segment WB&A Road has steep slopes on both side of the roadway, with guardrail and a riparian area. While these can be mitigated with footer-based retaining wall, the preferred alignment recommends using the Redwood Tree Road frontage road and sharing this with pedestrians and vehicles. The preferred alignment shows the side path sloping down to meet with Redwood Tree Road, as shown in Figure 66. Even though the frontage road continues to Sycamore Hill Road, the preferred alignment would continue again as a side path along WB&A Road, just north of Maple Tree Road.



Figure 66: Preferred Alignment, north of MD 174

The WB&A Road trail alignment presents a unique pedestrian safety challenge at the intersection of Queenstown Road as it is the only location with uncontrolled “free flowing” cross-street traffic. Queenstown Road is a two-lane facility with a speed limit of 35-mph. The intersection of Queenstown



Road at WB&A Road has an exclusive westbound right turn lane and flashing red and amber signal beacons to alert drivers of the two-way stop-control along WB&A Road, as shown in Figure 67.

Crossing treatment recommendations at Queenstown Road include installation of signage and pavement markings to improve visibility of the proposed trail crossing and its users. At a minimum, the crossing should include high-visibility crosswalk markings, trail crossing signs (W11-15 and W11-15P), way finding signage, and advanced crossing warning signs placed in each direction of Queenstown Road.

Future stages of design and analysis should also evaluate the following additional trail crossing treatments:

- **Pedestrian Refuge Island:** A pedestrian refuge island could be provided at the Queenstown Road trail crossing, within the existing roadway footprint, by consolidating the westbound through movement into the exclusive right turn lane and repurposing the existing through lane space. A pedestrian refuge island would further enhance pedestrian safety and comfort by allowing two-stage pedestrian crossing movements, slowing vehicular speeds, and reducing pedestrian exposure to continuous lanes.
- **Speed Table:** Raising the trail crossing at Queenstown Road on top of a speed table could further improve trail visibility, reinforce pedestrian right-of-way, and slow conflicting vehicles.
- **Traffic Control Devices:** A signal warrant analysis should be conducted in accordance with MUTCD guidelines to evaluate the appropriateness of a signal to provide trail protected trail crossing of Queenstown Road. If a signal is not warranted, another option would be to incorporate all-way stop control or to re-orient the existing two-way stop control to Queenstown Road – allowing trail users (and WB&A Road traffic) the uncontrolled movement.

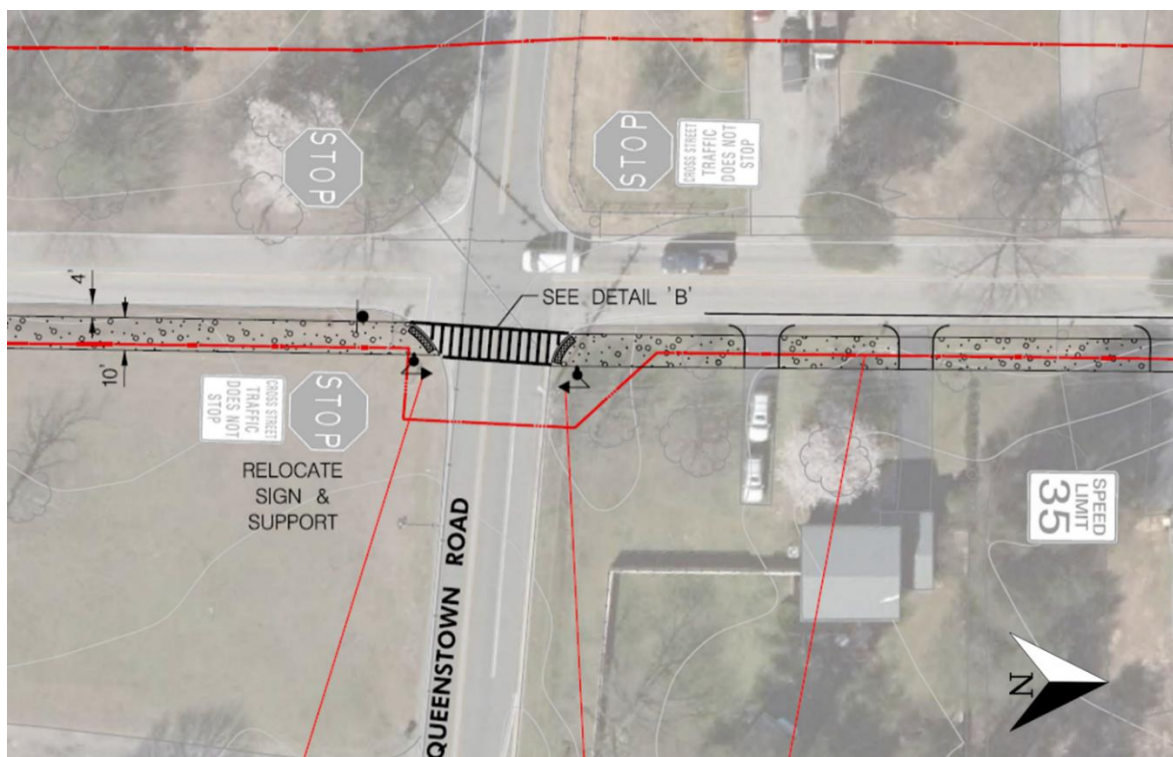


Figure 67: Preferred Alignment at the intersection of WB&A Road at Queenstown Road



WB&A Road crosses over MD 100 with a bridge span that is 30 feet wide, including 4-foot shoulders on each side of the north-south travel lanes. As shown in Figure 68, the preferred alignment consolidates the shoulders to the east side of the bridge span and approach grades, such that they are restriped for two 10-foot general purpose travel lanes, a 2' hatched buffer (with vertical separation) and an 8-foot wide two-way hiker-biker lane. This segment of Queenstown Road is also recommended for an advisory speed limit reduction down to 30 mph (from 35 mph) to account for the narrower lanes on the bridge⁶.

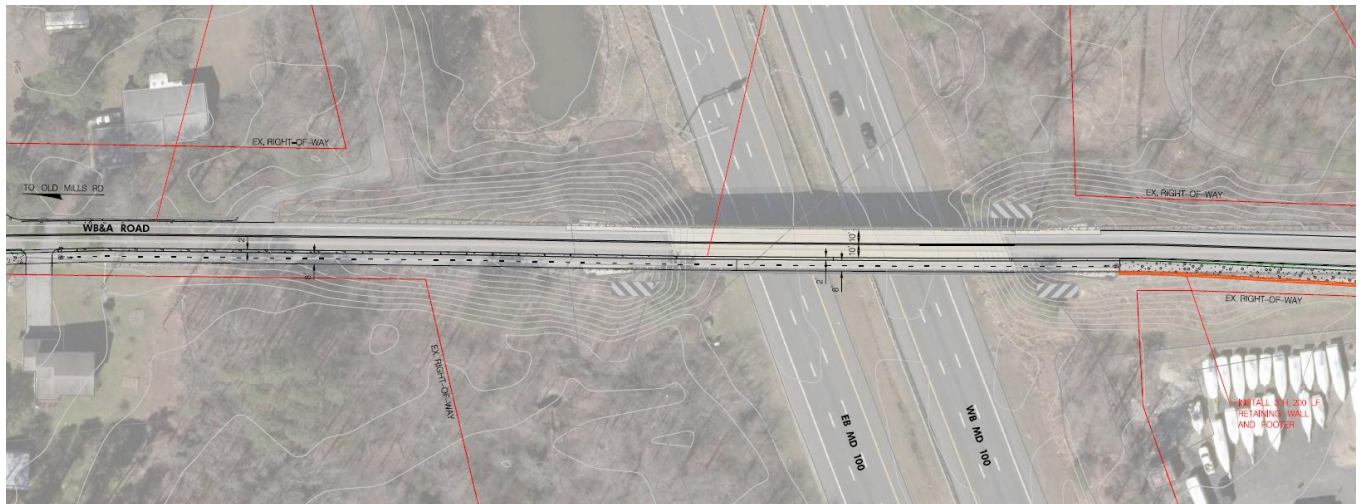


Figure 68: Preferred alignment along WB&A overpass over MD 100

Figure 69 shows the recommended typical cross-section for the bridge deck and approach grades. Note that the trail is separated from vehicle traffic using a pre-cast concrete curb with retroreflective flex posts placed on top. A similar example, also shown in Figure 69, is the retrofit of the bridge on Stoney Run Road over MD 170; this retrofit provides separated and protected side trail (for the BWI Trail) along the bridge deck and its approach.

If the separated facilities (using precast curbs and flex post) prove inadequate to provide a safe and convenient crossing for trail users, while also maintaining safety for vehicle traffic on the overpass⁷, then a separate parallel pedestrian bridge over MD 100 should be considered.

⁶ The AADT along this segment of WB&A Road is only about 4,000 cars per day.

⁷ A common metric to determine if a retrofit trail facility is safe and convenient is an increase in trail traffic over pre-construction conditions. Additionally, an increase in vehicular crashes on, or approaching, the overpass would indicate that the bridge is less safe than before the retrofit.

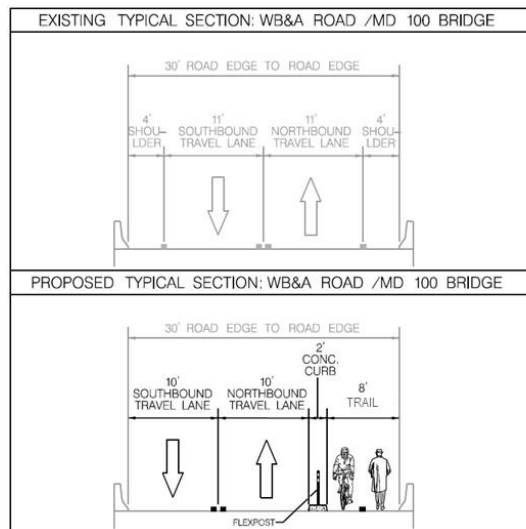


Figure 69: Recommended overpass cross section and exemplar side trail on Stoney Run Rd

The preferred alignment terminates at the BWI Trail along the north side of MD 176 (Dorsey Road), as shown in Figure 70. The alignment connects with the BWI Trail along the south side of MD 176 at the southeast quadrant of the signalized intersection. An existing crosswalk and pedestrian signal provide dedicated crossing across the south leg of the intersection, and a pedestrian-activated WALK signal exists for crossing to the northside of MD 176, where the BWI Trail continues westward.

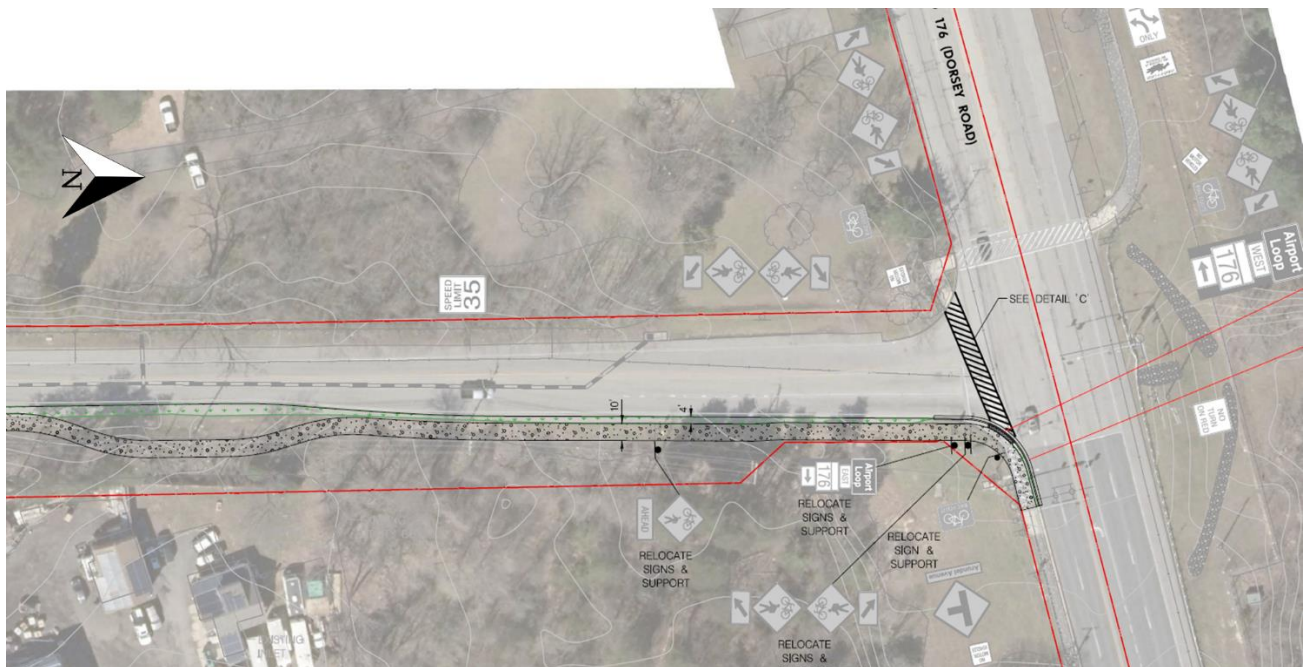


Figure 70: Preferred alignment north terminus and connection to BWI Trail

Cost Estimate

Based on the preferred alignment, the estimated construction cost is about \$6.8 million dollars. As shown in Table 11, which provides a planning-level breakdown of the estimated construction cost, the primary driver of cost is the construction of the asphalt trail itself, with other major costs including retaining structures, ROW takes, stormwater management facilities, and utility pole relocations.



Table 11: Conceptual Cost Breakdown by construction element

Construction Element	Sub Cost
10' path and 4' grass buffer	\$2,695,000
Relocate Utility Pole or Light Pole	\$510,000
Relocate sign pole	\$3,000
Curb and Gutter	\$281,000
Sidewalk Removal	\$89,000
Pavement Removal	\$280,000
Shall depth Retaining Wall	\$31,000
Retaining Wall with Footer	\$620,000
Prefab Concrete curb buffer for bridge over MD 100	\$101,000
Flex posts buffer for bridge over MD 100	\$6,000
ROW needs	\$480,000
Pedestrian Signals	\$110,000
Stormwater Management	\$400,000
Signing and Marking	\$25,000
Grading	\$250,000
MOT	\$100,000
Landscaping	\$200,000
Mobilization	\$20,000

Sub Total \$6,201,000
 10% Contingency \$620,100

TOTAL COST \$6,821,100

Estimated annual maintenance costs are expected to be about \$5,000 per year and related to annual evaluation of facility for signs of degradation; leaf/vegetation growth removal, snow removal and repairs for any cracks or potholes.

Summary of Design Details for Consideration during Next Phase of Project

Appendix F shows the preferred alignment developed to 10%, with additional details still needing to be refined in the next design phase. Additionally, there are several trail amenities and enhancements that are comprehensive to a regional trail of this scale. Details to be refined and amenities to evaluate during the next phase of design include:

1. Trail crossing of MD 32 westbound off-ramp at northbound Telegraph Road.
 - a. Consider removal of this channelized island would eliminate an uncontrolled trail crossing across a high-speed facility. The right turn channelization could be removed and replaced as a right turn bay at the intersection of the MD 32 westbound off ramp with Telegraph Road, or the right turn could be remove entirely and the exist thru-left lane could be re-stripped as a through-right turn lane – traffic analysis would have to confirm that this is feasible, but a preliminary review of traffic counts at the intersection suggest it is possible. Removing the right turn or shifting it to the intersection of MD 32 off-ramp at Telegraph Rd, would also have the added benefit of eliminating a short weave section between MD 32 and Old Mill Road along northbound Telegraph Road.
2. Consideration of removal of additional channelized right turns at:
 - a. Southbound right turn from Telegraph Road onto westbound MD 175
 - b. Eastbound right turn from MD 175 onto Southbound Telegraph Road
 - c. MD 32 eastbound off-ramp to southbound Telegraph Road



3. Evaluate the trail typical section along west side of Telegraph Road for areas to compromise on trail width or buffer width.
 - a. The presence of shoulders, sidewalk, utility poles, and limited ROW width all the application of the ideal 14' wide typical trail section. There may be opportunities to reduce trail width or buffer width for very short segments in order to avoid a costly utility pole removal or ROW take.
4. Where extra ROW width is available, determine where the County can *increase* buffer beyond 4 feet minimum.
5. There are two short segments of Telegraph Road portion of the Preferred Alignment that have an open section: 1) between the MD 32 eastbound ramps and Mayfield Rd; and 2) between Pine Ave and Lamonte Ave. Given that the trail along these segments will be located behind new curb, determine stormwater management, assuming a *closed* section along these two segments.
6. Determine how much ROW to obtain along north side of Old Mill Road between WB&A Road and Telegraph Road. The amount of ROW obtained will determine the width of a buffer space (for vegetation and roadside signs) but will also impact the amount of grading needed. Finally, if enough grass buffer is provided, Old Mill Road can an remain open section roadway. If the grass buffer is too narrow, then the roadway should be converted to a closed section for trail user safety.
7. Repurposing Shoulders and Turn Lanes.
 - a. Telegraph Road has narrow 4-foot shoulders along several segments of the preferred alignment. Determine if the roadway width applied to these shoulders can be repurposed toward the typical trail section, as the current designs retain existing shoulders. Repurposing the existing 4-foot shoulders reduces the overall net impervious surface increase.
 - b. Along WB&A Road there are several locations where shoulders and turn lanes are present. Given the low volume along the roadway and the fact that WB&A Road functionally serves as only a Collector road, evaluate the needs for repurposing the shoulders and/or turn lanes for trail construction. Current design leaves all shoulders and turn lanes intact, because the available ROW width is sufficient. But, repurposing existing pavement for a trail would ease constructability by limiting the amount of grading or retaining structures needed, and it will reduce the overall net increase in impervious pavement related to the project.
8. Determine the type of vertical protection along the WB&A Road overpass over MD 100. While MDOT SHA allows for flex posts with and without raised curbs, a more robust vertical separation would require less maintenance. An example is to use 18"-wide beveled pre-cast concrete curbs, shown in Figure 71, that are lag-bolted into the roadway similar to flex posts.
 - a. Additionally, evaluate a reduced speed limit over the bridge, as the lanes will be narrowed and/or shoulders removed.
9. General SWM Design considerations
 - a. Determine if and where pervious pavement is applicable
 - b. Evaluate where existing extraneous pavement can be repurposed
 - c. Evaluate where linear SWM facilities can be applied

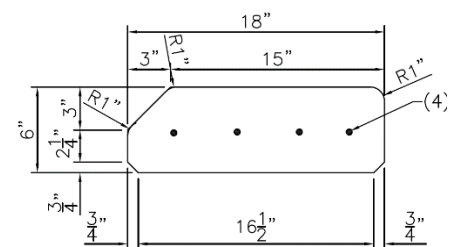


Figure 71: Cross-section of an 8-ft long pre-cast concrete curb



- d. Evaluate opportunities to treat untreated runoff in same watershed(s).
10. Evaluate trail amenities and their potential locations.
 - a. Evaluate the need for new trail lighting from southern WB&A Road terminus, along Old Mill Road, to Telegraph Road.
 - b. Evaluate potential trailhead locations with the possibility of adding informal parking areas. A potential location for a trailhead is at the southern terminus of WB&A Road, where ample ROW exists. This location could also provide public parking, a water fountain, a pocket park, bike rack, benches, lighting, WB&A Historical signage, mileage markers, or other amenities.
11. Evaluate locations and destinations for wayfinding signage with mileage markers. There are several destinations along the overall project length, including the WB&A Trail connection, Odenton MARC station, Severn-Danza Park and sports complex, Chesapeake BMX motocross track, BWI Trail connection, and the Dixon Observation Area and park.
12. Trail crossings over driveways should be evaluated to determine where it is appropriate for the trail to remain at-grade through the crossing and where it is appropriate for the trail to slope down to road-grade, giving preference to ingressing/egressing vehicles. The ideal condition for trail users provides no slope changes through a driveway crossing, as shown in Figure 72. However, there may be locations – particularly in commercial areas – where driveway entrances need to remain at road-grade, requiring trails to slope down through the crossing.

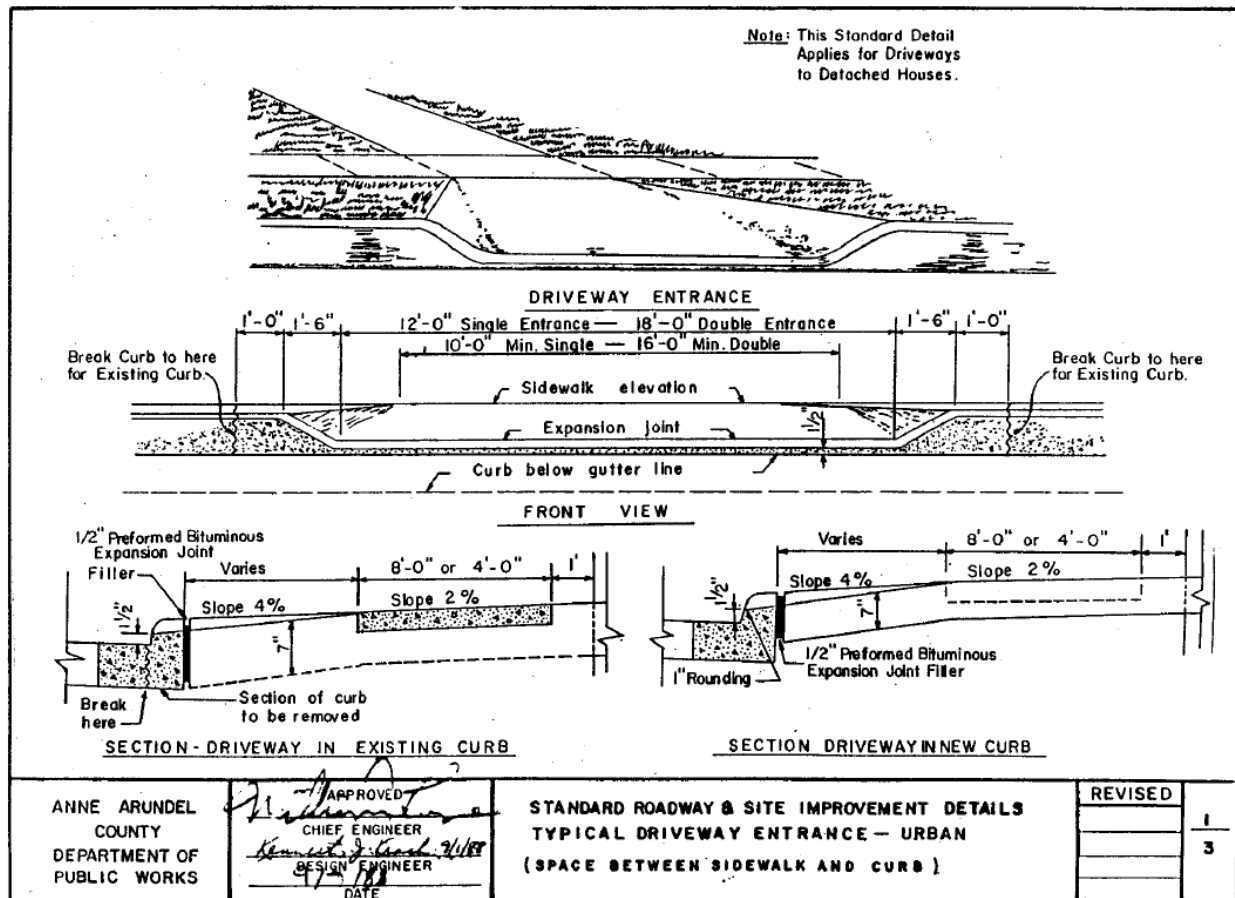


Figure 72: County Standard for sidewalk remaining at grade while crossing a driveway



c. Prioritization of Alignment Segments

The Preferred Alignment for the future BWI to Odenton Trail is approximately 6 miles long with design challenges and construction costs that vary along each segment. Additionally, different segments of the project can have widely-varying timelines from concept to design to construction due to factors such as: coordination across multiple jurisdictions; the need to acquire ROW; design complexity; or costs that are prohibitive – where funds must be accumulated over successive fiscal budget years.

In order to prioritize project elements, segments were evaluated for how quickly they can be designed and constructed and how critical the elements are for providing safe passage. Table 12 prioritizes the elements of the preferred alignment, so that they can be designed and programmed for funding:

Table 12: Priority of Project Segments

Segment		Reasoning
1	Pedestrian Signal for crossing south leg of Telegraph Road at MD 32	Critical crossing at major road that is currently used by cyclists to cross Telegraph Road (as evident by the goat path on the west side of the underpass).
2	Side Path along east side of Telegraph Road from Old Mill Road to MD 32 westbound ramps	700-foot section currently is shouldered but requires cyclists to face opposing traffic instead of biking with traffic.
3	Lane Reconfiguration of WB&A Road Overpass at MD 100	Design and Construction for re-striping can be accomplished quickly, providing separated biking facilities along the portion of WB&A Road with the most vehicle volume.
4	Asphalt Ramp from Old Mill Road to WB&A Road terminus.	150-ft asphalt ramp is entirely in County ROW and will allow cyclists on WB&A Road to directly access low-volume Old Mill Road which provides access to the Telegraph Road corridor. This ramp will prevent the need for cyclists to use Private church property for access between Telegraph Road and WB&A Road.
5	Side path along west side of Telegraph Road from Odenton Road to MD 32	This 1.2-mile segment is along a high-volume road with only narrow 4' shoulders or sidewalk available for cyclists who choose not bike in the travel lanes.
6	Side path along east side of WB&A Road from MD 176 to Old Mill Road	This 4.5 mile segment is low volume and is currently used by north-south cyclists in the area.
7	Side Path along the north side of Old Mill Road	Old Mill Road is low-volume and can accommodate cyclist temporarily until ROW is acquired along the north side.

7. Next Steps

The next step to progress the project toward construction is to conduct topographic survey, where needed, and develop 30% Design Plans. During the development of these plans there may be need for additional community input where there are multiple design options with trade-offs between safety, cost, and timeliness of construction. During this design phase, stormwater management concepts should be developed and approved. Additionally, locations for any new trail lighting should be identified and specified. Locations and types of other trail amenities should be identified as well – including any



trailheads, trail parking, bathrooms, water fountains, and wayfinding signage. 30% Design and permitting can be expected to take at least a year but may require more time if ROW negotiations are required.

Where ROW is needed, evaluate whether to adjust the trail design to accommodate the side path or to begin ROW/easement negotiations. An example of adjusting the trail design would be to utilize part of an existing shoulder or to compromise on buffer width for a short segment where ROW is constrained along a given parcel.

A final output of 30% design will be a refined Engineers' cost estimate for the construction of the project. During this design phase, also identify potential funding sources for final design and for construction for each of the segments identified in Table 12. Several Federal and State grants are available for both design services and for construction of trail facilities.

a. Implementation and Funding Strategies

Funding for projects can often be an obstacle to implementation. In addition to using local funds, there are several state/federal grant programs that offer monetary support for implementing the recommended bicycle facilities in this study. The following funding sources have been identified as applicable and potential grant program.

Transportation Alternatives Program (TAP). This program is administered and supported by the Maryland State Highway Administration, with reimbursement from the Federal Highway Administration, for the purpose of funding projects that enhance the cultural, aesthetic, historic, and environmental aspects of the State's intermodal transportation system. The program is set up to sub-allocate fifty percent of the funding directly to local Metropolitan Planning Organizations who are the responsible reviewers of proposed projects within their jurisdiction. Recommendations under this study would be eligible as they meet the requirements of 1) related to surface transportation; and 2) meet at least one of the nine qualifying TAP categories. Project sponsors are responsible for design, management, construction, implementation, and permits as well as a minimum of 20% of all project costs.

MDOT Kim Lamphier Bikeways Network Program. Supported and administered by the Maryland Department of Transportation, the goal of the program is to fill in the gaps in Maryland's bike network to support bikeshare programs. An eligible project meets one of the following criteria: 1) located substantially within the Priority Funding Area (PFA) and/or located within three miles of a rail transit station or major bus transit hub, 2) provide or enhance bicycle access along any gap identified in the Statewide Trails Plan "A Greener Way to Go", and/or 3) identified as a transportation priority in a County's most recent annual priority letter submitted to MDOT. The local match requirements are 20% for all Bikeways Program grants. The match may include cash or in-kind services contributing to the project such as expenditures up to twenty-four months prior to a Bikeways project award.

Recreational Trails Program. Administered by the State Highway Administration and supported by an 80/20 federal to local match, this program funds community based, motorized and non-motorized recreational trail projects. The trails can be for pedestrian and bicycling paths as well as for specific uses such as in-line skating, cross-country skiing, equestrian use, and four-wheel driving. The program funds not only new construction of trails, but maintenance and restoration of existing trails, purchase or lease of trail construction equipment, acquisition of easements or property for trails, and implementation of interpretive/education programs to promote intrinsic qualities, safety, and environmental protection.



The matching funds must be committed in the local jurisdiction's budget and awards may not exceed \$40,000 for new construction and \$30,000 for other projects. Preferred programs to be funded include the following characteristics: connect communities with natural/cultural areas or tourism areas (e.g., Scenic Byways, Heritage Areas, Canal Towns); have broad-based community support; complete a missing link in the State Trails Plan; or link or complete existing trails.

In addition to grant funding, it is expected that the majority of the costs of design and construction will be funded by the County, through its Capital Improvement Program (CIP).

8. Executive Summary of Findings and Recommendations

- The Anne Arundel County Department of Public Works received grant funding through MDOT's *Bikeways Network Program* for a feasibility study for a six-mile trail connection between the BWI Trail and the WB&A Trail northern terminus, near Odenton Town Center / Odenton MARC Station.
- This feasibility study outlines potential new trail alignments; conducts a high-level analysis of these alignments across multiple metrics; selects a preferred alignment and designs it to 10% plan level; documents all analysis data and findings; and provides recommendations for further evaluation during the project's 30% design phase.
- Both side of two corridors were initially explored for the feasibility of incorporating a new shared used path or trail: Telegraph Road (MD 170) corridor and the WB&A Road corridor.
 - A third option, not considered under this feasibility study, utilizes existing and County-planned trail segments that provide access to major employments centers. However, this option – which utilizes MD 176, Arundel Mills Blvd, Milestone Pkwy, and MD 175 – is several miles to the west of the study area, does not provide a direct route, and is already in various stages of planning of design.
- The County identified an ideal minimum trail cross-section that is 10' wide asphalt trail with 4' minimum grass buffer from any roadway. This trail cross-section was overlaid on *Existing Conditions* base maps, developed in CAD, for both corridors evaluated, in order to determine all obstacles and barriers to construction.
- In addition to the two primary north-south corridors, multiple options were developed for terminating alignments in the north and south end of the study area.
- Both primary alignments and terminating options were evaluated and compared for multiple factors: public input; safety and feasibility of overcoming safety challenges; design / constructability; right of way acquisition needs; environmental impacts; construction cost; and ability to connect to nearby destinations / neighborhood access.
- Public outreach was held virtually to solicit feedback, using an online survey. A project website with a recorded presentation and maps of potential alignments was provided to help respondents with their input and feedback. The public input was largely in favor of the WB&A Road alignment over the Telegraph Road alignment, citing calmer traffic and no interchange crossings.
- The preferred alignment, based on all the factors weighed, is to utilize the east side of the WB&A Road corridor from the BWI Trail south to Old Mill Road. The preferred alignment continues along the north side of Old Mill Road westward to Telegraph Road, where it



transitions from the east side to the west side of Telegraph Road, just north of MD 32, prior to terminating at Odenton Road.

- Multiple new intersection safety improvements are recommended in concert with the preferred alignment, including new pedestrian signals and right-turn channelization removal at select locations. Other intersection improvements recommended for consideration in the 35% design phase include select lane reconfiguration and alternative traffic control devices to enhance trail crossing safety.
- The projected cost of the preferred alignment is \$6.8 million, with the primary driver of cost being the construction of the hard surface trail itself, along with retaining structures, ROW purchases, and utility pole relocations. Because the project is not likely to receive design and construction funding in its entirety all at once, the preferred alignment was broken into several segments in order to prioritize the most impactful segments.
- The next step to progress the project toward construction is to conduct topographic survey, where needed, and develop 30% Design Plans with stormwater management concepts, lighting needs, permitting needs, and trail amenities identified and to finalize all design considerations identified in this report.