Section 7: DETAILED EVALUATION OF RETAINED MULTI-USE TRAIL CORRIDOR OPTIONS

Based on preliminary results, the Red and Orange Corridor Options were found to be the two options that meet both the purpose and need, and represented the least impact to wetlands and streams. These corridors were then considered in the detailed evaluation with consideration given to cost and feasibility of implementation to identify the most practicable preferred corridor.

Purpose and Need Considerations for the detailed evaluation of the Red and Orange Corridor Options included:

- The corridor's length along VDOT's PSAP corridor
- Ability of the corridor to meet LTS 1 (an LTS 1 facility has a strong separation from traffic, except low speed and low volume traffic, with simple crossings and is suitable for children)
- Number of Destinations of Interest within half-mile of the corridor
- Length on Existing or Planned Active Transportation Routes

In the detailed evaluation, consideration was also given to cost and feasibility of implementation to identify the most practicable preferred corridor. Estimated impacts to wetland acres and linear feet of streams were also refined beyond the preliminary evaluation based on a review of aerial imagery and available desktop data interpreted using best professional judgement. Additional considerations for the detailed evaluation of the Red and Orange Corridor Options included:

- Wetland impacts
- Stream impacts
- Number of potential parcel impacts
- Number of Bridges
- Preliminary Cost
- Per Mile Cost
- Engineering constraints

As determined in the preliminary evaluation, the Orange and Red Corridor Options meet the purpose and need while providing the least potential impacts to environmental resources. The Red and Orange Corridor Options contain portions along VDOT's PSAP and meet the LTS 1, connect to the majority of destinations of interest within a half-mile compared to the other corridor options and the majority of the corridor aligns with existing or planned active transportation facilities. The detailed evaluation considered refined wetland and stream impacts, where the Red Corridor Option would potentially impact the least amount of wetland acres (7.6 acres) and the Orange Corridor Option would potentially impact the least amount of linear feet of stream (2,219 linear feet). **Table 7-1** provides a summary of the additional considerations utilized during the initial Detailed Evaluation of Retained Corridor Options, including the refined environmental impacts.

Table 7-1. Detailed Evaluation of Retained Corridor Options

Corridor Option	Detailed Evaluation Considerations		Recommended Preferred Corridor?
ORANGE	Wetlands (acres) [1]:	9.3	YES
	Streams (linear feet) [1]:	2,219	
	Level of Traffic Stress 1 Facility (%) [2]:	100.0	
	Separated Facility (% shared use path, buffered bike lane, and/or cycle track) [2]:	100.0	
	Shared Use Path (%) [2]:	88.8	
	Right of Way (number of parcels):	563	
	Number of Bridges [3]:	18	
	Preliminary Cost (Fiscal Year [FY] 2026 dollars) [4]:	$88,000,000.00	
	Per Mile Cost (FY 2026 dollars) [4]:	$2,120,000.00	
RED	Wetlands (acres) [1]:	7.6	NO
	Streams (linear feet) [1]:	3,031	
	Level of Traffic Stress 1 Facility (%) [2]:	100.0	
	Separated Facility (% shared use path, buffered bike lane, and/or cycle track) [2]:	96.9	
	Shared Use Path (%) [2]:	92.6	
	Right of Way (number of parcels):	1,006	
	Number of Bridges [3]:	16	
	Preliminary Cost (Fiscal Year [FY] 2026 dollars) [4]:	$147,000,000.00	
	Per Mile Cost (FY 2026 dollars) [4]:	$2,960,000.00	

[1] Wetland acres and linear feet of streams were measured within a 30-foot width along each corridor option, 15 feet on either side of the corridor option center line.

[2] Shared use paths, buffered bicycle lanes, and cycle track facilities offer bicycle and pedestrian accommodations that are physically separated from other traffic and represent LTS 1 facilities; other LTS 1 facilities can also include low speed, low volume shared roadways that do not include a physical separation from traffic but have a low speed differential and only occasional motor vehicle traffic. The total percentage of each corridor that could be implemented as a LTS 1 facility is measured in the ability of each corridor to meet purpose and need.

[3] Bridge numbers are the identified locations along the corridor where a new shared use path bridge would need to be constructed or an existing roadway bridge would need to be retrofitted to add a shared use path to the existing bridge (if determined feasible). Bridge numbers do not include locations where an on-road facility is proposed on a bridge, for example bicycle lane, buffered bike lane, cycle track, etc.

*[4] Preliminary costs are based on cost per mile per facility type (i.e. shared use path, bridge, on existing trail, rail-to-trail facility, on-road facility, etc.) with adjustment factors applied where implementation barriers, environmental impacts, or right of way constraints were identified. Additional information to support preliminary cost estimates is located in **Appendix D: Preliminary Cost Estimate Methodology**.*

The Red Corridor Option provided limited potential for impacts to wetlands and streams, compared to other corridor options. However, this corridor option presented considerable logistical challenges given the existing available right of way and implementation constraints. In certain areas of the Red Corridor Option, a separated facility would be required in order to meet a LTS 1; a LTS 1 would not be achievable with a shared roadway facility type due to traffic volume and speeds. Specifically, in the vicinity of Allen Avenue, Hermitage Road, and Lakeside Avenue, existing available right of way is limited and the implementation of a separated facility would require substantial infrastructure improvements and number of potential parcel impacts. As a result, preliminary costs are notably higher ($147,000,000) than the Orange Corridor Option ($88,000,000). For more detail on preliminary cost estimates, see **Appendix D: Preliminary Cost Estimate Methodology**. Considering the logistical challenges of the Red Corridor Option, the overall preliminary cost, and that the Red Corridor Option would result in higher stream impacts and similar anticipated impacts to wetlands, this corridor is not recommended to be the most practicable corridor option compared to the other corridor option retained for detailed evaluation.

In light of the overall project purpose and need and considering the potential for impacts to wetlands and streams, the Orange Corridor Option is anticipated to best address safety and connectivity and is consistent with state, regional, and local transportation planning. The Orange Corridor Option provides the most direct route and is anticipated to have a limited number of potential parcel impacts compared to the Red Corridor Option which would have similar potential impacts to wetlands and streams. In addition, the Orange Corridor Option provides the most cost-effective corridor option and as a result, is considered to be the most practicable corridor option based on anticipated impacts to natural resources, logistics, and preliminary cost. Therefore, the Orange Corridor Option is recommended as the preferred corridor.

The Orange Corridor is recommended as the preferred corridor due to the alignment most closely meeting the purpose and need, providing logistical feasibility, resulting in the least potential stream impacts, and with a preliminarily cost estimate of $59 million, (40%) less than the other corridor option retained for detailed consideration. As noted in **Table 3-2** in **Section 3: Agency/Stakeholder Coordination and Public Input**, after the July 26th, 2019 EAWG meeting, on July 31st, 2019 via email correspondence, the EAWG agreed that the Orange Corridor Option (preferred corridor) is expected to be the preliminary least potentially environmentally damaging option while representing the most practicable for implementation based on cost and logistic considerations.

This decision served as the USACE preliminary Least Environmentally Damaging Practicable Alternative (LEDPA) determination. However, as required by 404(b)(1) guidelines, the USACE can only authorize the LEDPA through its permit process. To be the LEDPA, an alternative must result in the least impact to wetlands and streams while being practicable, which means it is feasible after taking into consideration cost, existing technology, and logistics. Although the USACE agreed that the Orange Corridor appeared to be permittable, LEDPA determinations are made during the permitting process, which would follow any necessary NEPA study and be informed by more detailed designs[13].

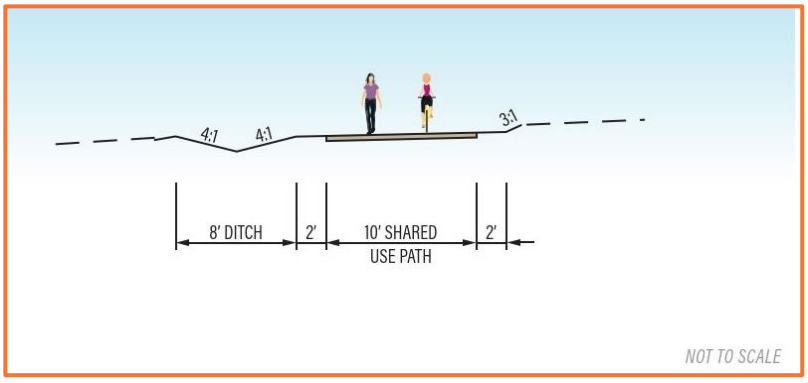
[13] No permits were secured as part of the planning study.

Figure 7-1. Recommended Facility Type

In addition to EAWG input, the STAG and the public were offered opportunities to provide feedback on the recommended preferred corridor. Based on coordination and feedback with the STAG during and following the July 29th, 2019 meeting, it was determined that the preferred corridor would be modified and evaluated as a 100% shared use path facility type. In order to provide a consistent comparison during the detailed evaluation of the retained corridor options while identifying a preferred corridor , the Red and Orange Corridors were both modified and evaluated as 100% shared use path facility types.

A shared use path is an active transportation facility that supports multiple recreation and active transportation opportunities[14]. **Figure 7-1** illustrates the recommended type of facility, shared use path. Regardless of where the trail corridor is proposed, the trail type is recommended to be consistent throughout; however, detailed typical section design, including facility type, will be determined as segments advance to future phases of project development. **Figure 7-2** illustrates a potential shared use path facility type typical section.

Figure 7-2. Recommended Facility Type Example Typical Section



During the development and evaluation of the preliminary corridor options, a number of facilities were utilized, such as sidewalks, bicycle lanes, shared roadway, or other facilities that provide accommodations for bicyclists, pedestrians, or other active transportation modes. Although a number of facility types, such as separated bicycle lanes or cycle tracks with a physical barrier protecting users from motor vehicles, in combination with a sidewalk or other facility for pedestrian and wheelchair users, offer the same opportunities for safe, low-stress active transportation as a separated shared use path, a shared us path was preferred by the STAG and public. **Table 7-2** is an updated, detailed evaluation summary table of results based on the retained corridor options being modified to 100% shared use paths.

[14] Consistent with FHWA guidance, although the terms 'shared use path' and 'trail' are sometimes used interchangeably, it is assumed that this facility would meet VDOT's RDM and FHWA guidance for shared use paths where all design criteria for shared use paths to be designated as bicycle facilities would be required (FHWA, 1998; VDOT, 2019).

Due to the potential for changes to impacts on environmental resources, the changes to the recommended preferred corridor were presented to the EAWG during the September 11, 2019 EAWG meeting. Based on the modifications to the preferred corridor not resulting in additional impacts to streams and wetlands, the EAWG confirmed that the Orange Corridor Option is the preferred corridor and is the most practicable option for implementation when also considering cost and logistics.

The detailed evaluation of the retained corridors and the preferred corridor with all modifications were presented at the public involvement meetings in September and October of 2019. Additional consideration was given to the public input received on the preferred corridor; however, a majority of the feedback received on the preferred corridor had been evaluated during the detailed evaluation process. Therefore, the public input did not result in additional modifications to the preferred corridor. As discussed in **Section 3: Agency/Stakeholder Coordination and Public Input**, the presented preferred corridor was supported by public feedback received during the public meetings and subsequent comment period.

After the updated detailed evaluation, coordination, feedback, agreement from the STAG and EAWG, and positive input received during the public comment period, the Orange Corridor Option remained the preferred corridor. **Figure 7-3** provides an overview of the preferred corridor and termini.

Preliminary Cost Estimates Approach

Planning-level cost estimates were developed during the detailed evaluation of the retained corridors options. The planning-level cost estimates account for high-level design, preliminary engineering, and construction. The estimates reflect the following considerations: bridges, abandoned rail line to trail configuration, and baseline planning-level right of way costs. However, as part of the planning process preliminary cost estimates, an evaluation of the right of way impact and utility relocation costs was not performed. Preliminary costs are based on cost per mile, per facility type (i.e. shared use path, bridge, on existing trail, rail-to-trail facility, on-road facility, etc.) with adjustment factors applied. Adjustment factors were applied on a per segment basis where barriers or constraints (e.g. implementation challenges, such as steep slopes or complex infrastructure) or environmental impacts (i.e. wetlands and streams) were identified. Additional information to support the preliminary cost estimates is located in **Appendix D: Preliminary Cost Estimate Methodology**.

Existing and planned bicycle and pedestrian facilities were reviewed and referenced from state, regional, and local active transportation planning documents which can be found in **Table 2-7** in **Section 2: Study Purpose**. By coordinating with localities, metropolitan planning organizations, planning district commissions, and interested stakeholders and associated planning documents, this study is intended to expand on existing and planned active transportation facilities.

Preliminary cost estimates were initially developed for the detailed evaluation to determine a preferred corridor when the retained corridor options included varying facility types, including: shared on-road facilities, shared use paths, separated bicycle lanes or cycle tracks with a physical barrier protecting users from motor vehicles, in combination with a sidewalk. These various facility types were considered along the retained corridor options as context-sensitive and cost-effective solutions where similar existing or planned infrastructure is already identified or where implementation constraints, such as limited right of way, slope and topography, utilities, stormwater drainage, and traffic control device conflicts are present. **Table 7-1** displays the initial preliminary cost estimates.

Preliminary cost estimates were revised after the retained corridor options were modified to 100% shared use path facilities. **Table 7-2** displays these preliminary cost estimates. The following summary provides additional detail on the methodology used to develop the planning-level cost estimates at both points in the detailed evaluation. Additional information to support the methodology used for the preliminary cost estimates is located in **Appendix D: Preliminary Cost Estimate Methodology**.

Unit Costs (Per Mile):

The total project cost of the Virginia Capital Trail was utilized as a baseline for this study's cost assumptions. The Virginia Capital Trail cost approximately $1,400,000 per mile (2016 dollars), including design and construction. The shared use path cost per mile used in this study was derived from the Virginia Capital Trail cost and was multiplied by the mileage of the study's retained corridors.

The Virginia Capital Trail corridor is located in a mostly rural, agricultural land use area and as a result, there were minimal utility and right of way impacts and associated costs. For this study, the corridor options retained for detailed evaluation span along different land use areas than the Virginia Capital Trail; including large stretches of Central business district, outlying business/Suburban high density, and Residential/Suburban low density. Other differences from the Virginia Capital Trail include more significant potential for impacts to residential and commercial properties. The retained corridors are also expected to have a higher number of impacts to existing utilities than the Virginia Capital Trail due to the differences in area types and land uses. The planning-level cost estimates did not, however, evaluate the increases in right of way and utility costs that are expected to occur due to higher market values and differences in land use types.

Therefore, the per mile costs utilized for the evaluation in this study only included the incurred Virginia Capital Trail construction right of way and utility relocation costs and did not include an independent right of way and utility relocation evaluation. As part of the detailed evaluation process, a contingency was applied to the corridor option with more potential for parcel impacts, however, no right of way evaluation was performed. During STAG and EAWG coordination and the public involvement process, meeting materials indicated that all preliminary costs did not include a right of way evaluation.

An additional increase in cost that is expected to occur is the standard cost of living increases. Similar to VDOT's Project Cost Estimating System, an inflation rate of 2.5% per year was applied to the per mile unit costs to reach the Fiscal Year (FY) 2026 costs. Costs are based on FY 2026 as that is the first year funds would be available from SMART SCALE (FY 2022-2027 Six Year Improvement Plan) (VDOT, 2017). Due to the high level of detail necessary for SMART SCALE applications compared to other funding programs, the preliminary cost estimates were based on SMART SCALE funding requirements and therefore FY 2026 was used. Although the preliminary cost estimates were developed based on FY 2026, other funding mechanisms could be utilized prior to FY 2026.

In addition to the base cost per mile discussed above for a new shared use path where there is no existing facility, the planning-level cost estimate utilized additional base costs per mile that account for different proposed facility types (bridge, urban constrained shared use path, or on-road facility) and for different existing conditions (existing trail or existing abandoned rail line). Following is additional information on how additional base costs per mile were derived:

Existing Path/Trails and Existing Abandoned Rail:

This study accounts for instances where the corridor options are located along existing or funded active transportation facilities. The preliminary cost estimates consider where the retained corridor options were located on existing and planned active transportation facilities. Costs for new shared use path constructed on an existing trail/path or abandoned rail are based on total project costs of similar awarded and/or completed construction projects. These costs account for any additional clearing, grubbing, grading, or asphalt that may be needed to upgrade an existing trail or abandoned rail to shared use path standards.

On-Road Facilities:

On-road facility costs were based on total project costs of similar projects involving constructed bicycle on-road facility projects and associated average unit costs.

Shared Use Path (Urban Constrained):

Shared use path costs within an urban, constrained area are based on total project costs on similar projects involving curb relocation into the roadway and all necessary work associated with such.

Bridges:

This study considers the potential for new bridges and bridge improvements to cross water features, roadways or rail lines. This study assumes shared use path bridge costs of $350 per square foot based on total project costs of similar awarded and/or completed construction projects for similar bridges as a base cost. Costs were then adjusted using engineering implementation or environmental cost factors, if warranted.

Table 7-2. Detailed Evaluation of Retained Corridor Options as Shared Use Paths

Corridor Option		RED	Modification Comparison	ORANGE	Modification Comparison
Modification	Shared Use Path (%):	92.6	100	88.8	100
Purpose and Need Considerations	Length Along VDOT's Pedestrian Safety Action Plan Corridor (mi):	5	No change	6	No change
	Destinations of Interest (w/in 0.5 mi):	18		17	
	Length on Existing or Planned Active Transportation Route (mi (%)):	44 (88%)		34 (82%)	
Additional Considerations	Wetlands (acres):	7.6	No change	9.3	9.2
	Streams (linear feet):	3,031		2,219	No change
	Level of Traffic Stress 1 Facility (%):	100.0		100.0	
	Preliminary Cost (FY 2026 dollars)*:	$147,000,000.00	$167,000,000.00	$88,000,000.00	$106,000,000.00
	Per Mile Cost (FY 2026 dollars)*:	$2,960,000.00	$3,358,000.00	$2,120,000.00	$2,414,000.00
	*Preliminary costs should only be used for comparison purposes. Preliminary costs are based on cost per mile with adjustment factors applied where implementation barriers, environmental impacts, or right of way constraints were identified. Additional information to support preliminary cost estimates is located in **Appendix D: Preliminary Cost Estimate Methodology**.				

Figure 7-3. Preferred Corridor