CONCEPTUAL BRIDGE REPLACEMENT STUDY
ROUTE 674 (HUNTER MILL ROAD)
OVER COLVIN RUN

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EXECUTIVE SUMMARY

This conceptual study was prepared for the Virginia Department of Transportation to identify alternatives to replace the Route 674 (Hunter Mill Road) Bridge over Colvin Run in Fairfax County. (Structure #0296077-06829).

The existing structure is a 30 ft, single span one-lane bridge with a timber deck on steel beams and no skew. The substructure consists of two concrete gravity abutments founded on firm material with temporary support brackets installed and one temporary timber bent near mid-span. Originally built in 1974, the bridge is now structurally deficient due to a condition rating of 3 for the steel beam superstructure. The bridge is posted for a 19 ton weight limit and has a sufficiency rating is 23.5.

Hunter Mill Road is a scenic byway, and the replacement of this bridge has been the subject of investigation for nearly 20 years. Since the existing one-lane bridge does not match the two-lane roadway approaches, a previous bridge replacement project was pursued by VDOT to improve the geometrics to meet current design standards. As the condition of the bridge has continued to deteriorate, the existing bridge has been identified as a candidate for State of Good Repair Funding. This concept study investigates bridge replacement alternatives that would eliminate a structurally deficient bridge while addressing the concerns of the local community.

The alternatives that are presented in this study are as follows:

- Replacement with a new one-lane bridge
- Replacement with a new two-lane bridge using phased construction
- Replacement with a new two-lane bridge using full road closure and detour.
- Replacement with a new two-lane bridge using a temporary bridge (on-site detour)

A high level cost analysis and estimated construction duration is given for each viable alternative. The pros and cons of each alternative are presented including discussions of utility impacts, right of way impacts, traffic impacts, the hydraulic capacity of the proposed structure, and design exceptions or waivers that will be required.

A hydraulic analysis has been conducted for each alternative to determine the hydraulic opening required for a range of storm events (2, 5, and 10 year) with overtopping of the proposed bridge evaluated for a 25 year storm event.

Each replacement alternative is compatible with either a steel beam or prestressed concrete voided slab superstructure. Once an alternative is selected, the Stage I report will further examine these bridge types. For the purposes of this concept study, a prestressed concrete voided slab superstructure is presented due to benefits such as improved hydraulic capacity, reduced debris accumulation, and rapid bridge construction.
Based on the information presented in this report, replacement with a two-lane bridge using phased construction is recommended for this project. Though it is not the lowest cost alternative, a two-lane bridge provides initial and long-term benefits that cannot be achieved with a new one-lane bridge. The additional bridge width allows traffic to be maintained throughout construction without requiring a lengthy detour or temporary bridge. This reduces traffic impacts while avoiding significant adverse environmental, utility and right of way impacts. A two-lane bridge significantly improves the functionality and safety of the permanent facility, ensuring that the upfront investment has the highest long-term benefit to the travelling public.

The current and future traffic volumes far exceed the typical limit for which a design waiver would be approved for a one-lane bridge. The proposed two-lane configuration will match the existing approach roadways and the site will remain in character with this portion of Hunter Mill Road.
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ROUTE 674 (HUNTER MILL ROAD) OVER COLVIN RUN

PROJECT LOCATION MAP

Route 674 (Hunter Mill Rd) Over Colvin Run
Fairfax County
ROUTE 674 (HUNTER MILL ROAD) OVER COLVIN RUN

1. INTRODUCTION

Route 674 (Hunter Mill Road) over Colvin Run is located 1.25 miles north of Route 267 Dulles Access Toll Road in Fairfax County in the VDOT Northern Virginia District. The existing structure is a 30 ft, single span one-lane bridge with a timber deck on steel beams and no skew. The substructure consists of two concrete gravity abutments founded on firm material with temporary support brackets installed and one temporary timber bent near mid-span.

Originally built in 1974, the bridge is now structurally deficient due to a condition rating of 3 for the steel beam superstructure. The bridge is posted for a 19 ton weight limit and has sufficiency rating is 23.5. To address the current structural deterioration, VDOT is considering bridge replacement alternatives.

Route 674 crosses Colvin Run in a tangent section at the bottom of a sag vertical curve. The existing roadway is designated as an Urban Minor Arterial (GS-6) with two 11 ft lanes and paved shoulders that vary approximately 2 to 4 ft with turn lanes on each approach. As this is a one-lane bridge carrying two-way traffic, the north and south approaches include signage directing motorists to yield to oncoming traffic. In effect, the one-lane bridge commonly results in a stop condition despite the roadway being posted for a 35 mph speed limit.

The most recent year (2015) Average Daily Traffic (ADT) is 7200 VPD with 0% trucks. The forecasted design year (2043) ADT is 11,000 based on a 1.0% annual growth rate.

2. PURPOSE OF STUDY

The purpose of this study is to present multiple alternatives for the replacement of the existing structurally deficient bridge. The study includes a description of each alternative as well as a high level cost analysis and estimated construction durations for each viable alternative. Bridge type, right of way impacts, utility impacts, traffic impacts, hydraulic impacts and any design waivers necessary for each alternative are also discussed.

Another purpose for this study is to recommend an alternative that is best suited for this project. The final decision of what alternative is selected will be made by VDOT. The alternatives that are presented in this study are as follows:

- Replacement with a new one-lane bridge
- Replacement with a new two-lane bridge using phased construction
- Replacement with a new two-lane bridge using full road closure and detour
- Replacement with a new two-lane bridge using a temporary bridge (on-site detour)
3. DESIGN CRITERIA

b. VDOT Modifications to AASHTO LRFD, II&M 80.5
c. AASHTO Manual for Bridge Evaluation, 2nd Edition
d. VDOT Road and Bridge Standards, 2016
e. VDOT Road and Bridge Specifications, 2016
f. VDOT Road Design Manual, 2008
g. VDOT Manual of the Structure & Bridge Division, Volume V, Part 2, Design Aids
h. VDOT Drainage Manual
i. Units used: English

4. UTILITIES

A topographic survey has been completed by VDOT personnel, dated 3/29/2017. This survey identifies several utilities at the bridge site that have the potential to conflict with bridge construction depending upon the scope of the project. These utilities and their associated potential for conflict are summarized as follows:

1. **Overhead power and telephone lines** are located approximately 40 ft west of the existing bridge and run parallel to Hunter Mill Road. It is anticipated that these lines will not conflict with construction activities.

2. **An overhead power line for street lighting** is located approximately 12 ft east of the existing bridge, running parallel to Hunter Mill Road. The closest street light pole is approximately 45 ft north of the existing bridge behind the guardrail. In the case of a one-lane bridge replacement, this power line has the potential to conflict with pile driving activities or riprap placement, which will require temporary relocation. For a two-lane bridge replacement, the roadway would be widened in this direction, and the utility will require permanent relocation to match the new edge of roadway.

3. **A Fairfax County Water irrigation valve** labelled “Warning Transmission Water Main” is located in the NE quadrant streambank, approximately 35 ft east of the existing bridge. The disposition of this water main is not currently known; however, it is likely that it also runs parallel to Hunter Mill Road. As this valve is located outside of riprap placement for each case, no major conflict is expected unless the temporary bridge option is selected to maintain traffic on-site. This temporary bridge and roadway would conflict with this water main.

4. **Sanitary sewer manholes** are located in the SW and SE quadrants of the bridge. These manholes are not expected to conflict with bridge construction, even if a temporary bridge is used. The survey also identifies an existing 25 ft sanitary easement running east to west between these manholes, suggesting that a sanitary sewer crosses Hunter
Mill Road approximately 30 ft south of the existing bridge abutment. This assumption is confirmed by Fairfax County GIS mapping (see Figure 1). This sewer has the potential to conflict with structure excavation for select backfill placement and temporary shoring if required for phased construction. At this time, only the top of manhole elevations are noted in the available survey, but once the exact location, size, and invert elevations of the sanitary sewer are obtained, it is expected that any conflict can be mitigated through conventional construction methods to avoid adverse impacts.

![Figure 1: GIS Mapping with Sanitary Sewer](image)

5. RIGHT OF WAY

The topographic survey also delineated the existing right of way limits for all properties in the vicinity of the bridge, shown in annotated format in Figure 2. Based on this survey, it appears that permanent right of way will be required only at the SW quadrant of the bridge, a property owned by Fairfax County Park Authority. Due to the proximity of this property boundary to the existing bridge, this proposed permanent right of way will be required for all bridge replacement cases considered.
Temporary construction easements may be required to tie in toes of slope on the east side of Hunter Mill Road, depending upon which case is considered. To accommodate a wider roadway, the two lane bridge case is expected to require grading that could affect multiple properties on the east side of Hunter Mill Road. This would include reconstruction of the “Rails to River Trail” entrance and a large portion of the parking area, also seen in Figure 2.

6. HYDRAULICS / RIVER MECHANICS

A Hydrologic and Hydraulic study has been completed to assess the existing conditions of the Hunter Mill Road over Colvin Run bridge crossing. This study has determined that the drainage area for Colvin Run at this location is approximately 5.04 square miles, and the existing land uses within the drainage area consist primarily of residential neighborhoods.

Based on the results of H&H modelling, the existing bridge opening over Colvin Run is adequate for an Urban Minor Arterial road system. The 2, 5, 10, and 25-yr storms pass without
overtopping the existing structure. All other storms are overtopping the bridge. The 10-yr and 25-yr events yield freeboards to the existing low chord of 2.50 ft and 1.18 ft respectively.

Since the bridge is located within a designated Zone A FEMA flood plain, the hydraulic conditions of a proposed bridge could be permitted to raise the water surface elevation of the 100-yr storm by up to 1 ft from the calculated existing conditions model. However, to improve hydraulics, the proposed structure will be sized to maintain the existing low chord elevation while increasing the span length from 30 ft to 40 ft. This increased span length will also help to better align the bridge opening with Colvin Run at the inlet, reducing the potential for scour that is currently evident at the existing Abutment B, shown in Figure 3.

![Figure 3: Scour at existing Abutment B up to 2 ft deep](image)

H&H analysis shows that each proposed alternative meets the requirements of VDOT Drainage Manual Section 12.2.4 Department Criteria. Each alternative matches or lowers the 100-yr water surface elevation, resulting in no backwater increase over existing conditions. More than 18” of freeboard is provided from the low shoulder for the 25-yr flood, the selected design storm for an Urban Minor Arterial Street System. For FHWA reporting purposes, the largest storm event that will pass under the low chord with at least 1 ft of freeboard is the 25-yr event for one-lane bridge alternatives and the 10-yr event for the wider two-lane alternative.

7. ENVIRONMENTAL CONSIDERATIONS

Since the edge of Colvin Run is in contact with the existing abutments and there is a temporary bent installed, in-stream work will be required regardless of the alternative selected.
Cofferdams will be used for the demolition of the existing substructures, construction of the proposed abutments, and installation of riprap. The Contractor may also elect to construct a causeway or temporary work bridge to facilitate construction.

For the span length being considered, it is anticipated that there will be riprap installation below ordinary high water, a justified countermeasure against the current scour observed at the site. Additionally, some in-stream work will likely be necessary to realign an existing drainage ditch that runs parallel to Hunter Mill Road at the NW corner of the bridge. The existing slope at this corner is currently eroding and is approximately 1¼:1 which will not be acceptable for a newly constructed slope. This work is expected to be minimal and will be conducted within existing right of way.

8. PEDESTRIAN & AESTHETIC CONSIDERATIONS

The existing bridge is located about 70 ft north of the “Rails to River Trail” which crosses Hunter Mill Road, connecting Lake Fairfax Park and Colvin Run Mill Park. Due to the trail’s proximity, previous studies for this bridge replacement have included consideration of a shared use path and accommodations for an equestrian trail under the proposed bridge.

The alternatives investigated in this study are consistent with the requirements of VDOT IIM-S&B-95, which establishes project eligibility, payment limits and eligible items of work for Structurally Deficient bridge projects using State of Good Repair (SGR) funding. IIM-S&B-95 states that bridge widening to accommodate bicycle or pedestrian facilities is not eligible for SGR funding unless the roadway already has such facilities. There is an existing shared use path that terminates approximately 325 ft north of the existing bridge, and there are no pedestrian facilities on the south side of the bridge. Extending this trail to the south across Colvin Run would require a significant amount of grading and right of way acquisition.

The vertical profile for the alternatives in this study also follows the guidance of IIM-S&B-95. The proposed profile matches the existing profile as closely as possible while maintaining the existing low chord on the bridge. Because of this, the span length of the proposed bridge was set at 40 ft in order to utilize a superstructure depth shallow enough to meet hydraulic requirements. Since the bridge is only 40 ft long, the stream will fill the entire area between the abutments, except for a small strip of riprap that will be placed along each abutment wall. There is no space available under the bridge for an equestrian trail unless the horses walk through the middle of the stream.

If a raised trail was constructed under the bridge so that the surface is above ordinary high water, the vertical clearance would be approximately 7 ft. This is well below the clearance required for a horse and rider to pass safely under the structure. The USDA Forest Service Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds states that a vertical
clearance of 10 ft is required for equestrian trails and 12 ft is preferred. Raising the vertical profile to meet this requirement would increase the project footprint which will increase environmental impacts and add significant roadway and right of way cost to the project.

The extra costs associated with widening the bridge to accommodate pedestrian facilities and the costs associated with increasing the height and length of the bridge to accommodate an equestrian trail are not eligible for SGR funding. This work does not meet the purpose and need of this project which is to address the structural deficiencies of the existing bridge.

Aesthetic treatment that is in accordance VDOT design guidelines, Volume 5, Part 2, Chapter 5, is eligible for SGR funding. VDOT will work with the local community to select a treatment that will enhance the structure so that it blends in with the surrounding area and maintains the historic character of Hunter Mill Road.

Regardless of the alternative selected, it is anticipated that a portion of the “Rails to River Trail” will need to be closed for the duration of the project. A temporary detour will be established to allow pedestrians to safely use this trail without having to pass through an active construction site. The trail entrance and parking area east of Hunter Mill Road will require modifications to restore trail connectivity after the project is complete.

9. SELECTION OF BRIDGE TYPE

The existing 30 ft bridge consists of 17 HP10x42 steel beams and a 5” timber plank deck with ±2” asphalt overlay for a total superstructure depth of ±1’-5”. The two most viable options to match this superstructure depth are prestressed concrete voided slabs and steel rolled beams. If design standards and guidelines for inverted T-beams are published prior to Stage I design, this type of superstructure will be presented as an alternative in the Stage I report.

A prestressed concrete voided slab bridge has several benefits over using steel rolled beams. These benefits include a smaller superstructure depth, a smooth bottom which prevents debris accumulation during high-water events, and rapid bridge construction which reduces the impact on the travelling public. The use of slabs is also beneficial when using phased construction, beam location with respect to the construction joint becomes less restrictive.

For these reasons, all alternatives considered in this concept study will use prestressed concrete voided slabs. The most recent year (2015) Average Daily Traffic (ADT) is 7200 VPD with 0% trucks. Per VDOT LD-104 request for traffic data dated 3/31/2017, the forecasted design year (2043) ADT is 11,000 based on a 1.0% annual growth rate. For the purpose of this concept study, it is assumed that the current truck percentage is significantly reduced by the current 19 ton weight restriction and that the design year Average Daily Truck Traffic (ADTT) is likely to exceed 200 trucks per day.
Therefore, the prestressed concrete slabs will have a 7½” composite concrete deck in accordance with Volume V, Part 2, File No. 12-05-1. The preliminary design charts included in Volume V, Part 2, File No. 12-05-9 indicate that 15” voided slabs with a concrete strength of 5 ksi can be used for the proposed 40 ft long bridge.

10. REPLACEMENT WITH ONE LANE BRIDGE

As discussed in Volume V, Part 2, File No. 6.01-6, VDOT’s general policy is not to build one-lane bridges. However, it is recognized that some conditions may warrant a one-lane bridge. It should be noted that new one-lane bridges require a design waiver approved by the State Structure and Bridge Engineer, and that such waivers are typically only considered when the design year ADT is less than or equal to 400 vehicles per day. Also, a letter shall be provided from the locality or county requesting a one-lane bridge.

The current and future traffic volumes far exceed the capacity of a one-lane bridge. The projected traffic volume for this roadway in the year 2043 is 11,000 VPD. This is almost 28 times the typical limit for a one-lane bridge. The long traffic backups that are present today will continue to grow which will be costly for motorists and will have negative impacts on the environment. A one-lane bridge also creates an unsafe condition. There is a documented history of vehicular crashes with four non-fatal accidents occurring at the site between 2012 and 2014, three of which appear to be related to the narrow one-lane configuration.

For these reasons, it has been determined that a one-lane bridge is not appropriate for this location and further consideration is not warranted.

11. REPLACEMENT WITH TWO LANE BRIDGE / PHASED CONSTRUCTION

BRIDGE DESCRIPTION

For a bridge replacement on an Urban Minor Arterial with an ADT greater than 2000 vehicles per day, VDOT Volume V, Part 2, File No. 06.02-7 requires a minimum curb to curb width of 42 ft. This includes two 11 ft lanes and 10 ft shoulders. However in keeping with the principle of “Common Sense Engineering” per IIM-LD-255, it is recommended that the required shoulder width be reduced to 4 ft. This reduction will require design exception approval in accordance with IIM-LD-227.11 / IIM-SB-70.9.

A design exception for shoulder and bridge width is justified since the intent of this project is to correct structural deficiencies, not to improve roadway geometrics. A minimum 4 ft shoulder is selected as it meets the minimum offset provided in Section 6.2.2 of the AASHTO “Green Book”. A 4 ft shoulder width on the bridge will meet with driver expectation and improve safety while reducing the length and overall cost of the project. Since the current
facility is a one-lane bridge, the addition of a second lane will dramatically improve the functionality and safety of the bridge.

Since the prestressed slabs are only available in 3 ft or 4 ft widths, the shoulders will be slightly wider than required. The most economical bridge typical section will consist of eleven – 3 ft wide prestressed slabs. This provides a curb to curb width of 30’-8”’. There will be two 11 ft lanes and 4’-4” shoulders. The railings will be 32” Kansas Corral concrete railings without curb, VDOT standard BCR-4. This rail meets the requirements in Volume V, Part 2, Chapter 25 and allows free drainage from the bridge without the use of deck drains.

The substructures will be conventional cantilever abutments with U-Back wingwalls to minimize right of way impacts. At this time, there is limited geotechnical information available for this location. The existing abutments are recorded as being founded on firm material, but it is not certain that this material will be suitable. Plans developed by VDOT in 1999 for the replacement of this bridge show HP12x63 (HP 310 x 94 metric) to support the abutments. It has been observed that the use of piling can add significant cost to projects, due in large part to increased select backfill material requirements. To account for this uncertainty, the cost estimate in this report assumes pile supported foundations, using HP10x42 steel piles.

The bridge will be widened to the east with a new centerline located 9 ft from the centerline of the existing bridge. Detailed in Figure 4, construction phasing will be used to maintain a single shared lane throughout construction. Partial demolition of the existing structure will be required for the installation of the temporary shoring that is needed to maintain phased traffic in close proximity to structure excavation.
Figure 4: Phased Construction Details
ROADWAY CONSIDERATIONS

The purpose of this project is to replace a small structurally deficient bridge on Hunter Mill Road over Colvin Run. Hunter Mill Road is classified as a GS-6 with a current ADT of 7200. The existing typical shows two 11 ft lanes with a 2 ft – 4 ft wide shoulder with guardrail located 1 ft from the edge of shoulder.

The proposed typical section of the roadway will be two 11 ft lanes with 2 ft – 4 ft shoulders on each side. In order to maintain this configuration across the proposed bridge, the alignment will have to taper out 185 ft on the south side and 245 ft on the north side. The overall length of impact from the horizontal taper and vertical tie-in to the existing roadway grade is about 495 ft in length (Sta. 104+70 to Sta. 109+65) including the bridge. The existing (2 ft – 4 ft) shoulder width will remain and tie into a shoulder width of 4'-4" in on the bridge.

The outside shoulder width for a GS-6 requires an 8 ft paved shoulder. As the proposed shoulder width will match existing (2 ft – 4 ft), it will be substandard. The design exception guidance provided in II&M-LD-227.11/II&M-S&B-70.9 acknowledges that the scope of this type of project is to correct structural deficiencies of the structure and not the correction of substandard approach geometries. The existing guardrail will have to be removed and replaced with a newer Mash Guardrail System.

The roadway centerline will need to be realigned in order for it to cross the proposed two-lane bridge with one-lane in each direction. This widening shifts the centerline of the roadway nine feet east of the existing centerline of bridge.

The approach on the south is on a curve, therefore the widened portion of the roadway will be constructed along a 500 ft radius curve. This satisfies the 35 mph design speed and minimizes the reconstructed area. The approach on the north side will have to taper from the new two-lane bridge centerline down to the existing roadway centerline. This linear taper for a width of 12 ft at a design speed of 35 mph will be 245 ft.

The current posted speed limit is 35 mph, however, the proposed vertical alignment is designed to 30 mph to match the existing condition. To design the proposed vertical alignment to satisfy the current speed limit would require a much larger length of the existing roadway to be reconstructed due to the steep approaching grade on both sides of the bridge. The vertical alignment of the roadway will be raised approximately 1 ft at the bridge in order to maintain the existing low chord elevation with the deeper proposed superstructure. The superelevation of the approach roadway will remain similar to the existing condition.

This option requires full depth pavement 20 ft north of the bridge abutment and 110 ft south of the bridge abutment. Due to the increased elevation in profile, milling and overlay (up to 10 in) will be needed 108 ft north of the full depth pavement and 42 ft south of the full depth pavement. Milling and overlay (0-2 in) will be 145 ft north of the variable depth milling and overlay and 30 ft south of the variable depth milling and overlay.
The entrance to the “Rails to River Trail” and parking area will be impacted. The entrance will be reduced and pushed further east and the angle of the entrance will need to be altered slightly. The entrance will need to be regraded approximately 65 ft east to tie into existing grade. This will occur outside of the existing right of way so a temporary easement will be needed. The roadway widening and associated 2:1 slopes are still within the existing right of way.

**STORM WATER MANAGEMENT / EROSION & SEDIMENT CONTROL**

All new development or redevelopment projects in Virginia are required to comply with the Virginia Stormwater management Program (VSMP) requirements. The stormwater management for the proposed improvement will be designed in accordance with VSMP Technical Criteria Part IIB. The water quality and water quantity requirements of the Part IIB technical criteria should be met for land-disturbing activity exceeding the land disturbance thresholds of one acre or greater (2,500 square feet or greater in a designated Chesapeake Bay Preservation Area, CBPA). The proposed improvement is located within Chesapeake Bay Preservation area and in a Zone A designated floodplain. This project has approximately 0.3 ac (13,000 sq ft) of land-disturbance exceeding the threshold of 2,500 sq ft. Therefore, VSMP regulations should be implemented. To meet the water quality requirements, the total phosphorous generated by the project will be calculated using Virginia Runoff Reduction Method (VRRM). The preliminary calculations indicate that the total Phosphorus generated by the project will be less than 10 lb/year; therefore, the water quality requirement will be met by purchasing the nutrient credit. Because the project is in a flood plain, water quality requirements are anticipated to be achieved by the 1% rule.

According to VDOT’s Erosion and Sediment Control standard, any maintenance or construction activity that disturbs more than 10,000 square feet, or 2,500 square feet in CBPA, must have a specific erosion and sediment control plan. The project has approximately 13,000 square feet of disturbance exceeding the threshold; therefore, a site specific Erosion and Sediment Control (ESC) Plan will be provided for the proposed improvement. Silt fence, turbidity curtains, check dams, and other ESC facilities will be used for the project in accordance with Virginia Erosion and Sediment Control Regulations (VESCR).

For an Urban-Minor Arterial road (GS-6), the roadside ditch capacity will need to be designed for 10-year storm in accordance with VDOT Drainage Manual. The proposed ditches will be analyzed using DitchSoftVA software from Ensoft Inc. The ditches will be protected from stormwater erosion based on 2-year post development peak discharge. The analysis results will be provided using standard VDOT LD-268 form.
TRAFFIC / MOT DESCRIPTION
The construction of a two-lane bridge, using phased construction, would allow for continuous access to Hunter Mill Road while providing greater long-term traffic capacity. Two options have been identified to facilitate the construction of a new two-lane bridge: 1) Two-way traffic along Hunter Mill Road could utilize the existing bridge or one lane of the ultimate two-lane bridge during each phase of construction. 2) Detour one direction of travel along Hunter Mill Road while maintaining one-way operation in the other direction by utilizing the existing bridge or a single lane of the ultimate two-lane bridge during each phase of construction.

12. REPLACEMENT WITH TWO LANE BRIDGE / DETOUR

The bridge and approach roadway for this option are identical to the option presented in Section 11. However, this section of roadway will be closed to traffic so the project can be constructed in a single phase.

TRAFFIC / MOT DESCRIPTION
The maintenance of traffic associated with the construction of a two-lane bridge with a full detour would consist of the following elements: 1) A full closure of the bridge during construction and 2) A detour of traffic along Hunter Mill Road, while only allowing local traffic between Crowell Road and Baron Cameron Avenue.

Figure 5 below includes the location of the site as well as the proposed detour route to be used during construction. During existing conditions (without detour), the length between points A and B along Hunter Mill Road is approximately 1.8 miles. The proposed detour route would add approximately 3 miles whereby increasing the distance between those two points to approximately 4 miles. The proposed detour will have to be coordinated with any other construction projects that may be planned along the detour route.
13. REPLACEMENT WITH TWO LANE BRIDGE/ TEMPORARY BRIDGE

In order to construct a new two-lane bridge in a single phase and reduce the length of the temporary detour, the use of a temporary bridge was investigated. The alignment for the temporary bridge would require a horizontal shift to the east of the existing bridge and subsequently a vertical change to the existing roadway.

Since the temporary bridge will have to be constructed approximately 10 ft east of the proposed two-lane bridge, the project footprint would increase significantly. The majority of the temporary roadway would be outside of existing right of way, so temporary construction easements would be required. The temporary roadway would run through the middle of the “Rails to River Trail” parking area, making it unusable for the duration of the project. The major disadvantage of this alternative is that it would not be possible to restore the area to its original condition after construction is complete because all of the existing trees on the east side of the Hunter Mill Road within the project limits would have to be removed.
The cost for this alternative will be significantly higher than the phased construction and detour options because of the temporary roadway and temporary bridge. Costs will also be higher due to increased right of way, environmental and utility impacts.

Since the temporary bridge would be a one-lane bridge, there is no real advantage to this option over the phased construction option. Both options will provide a one-lane crossing, which is the same as the existing condition.

For these reasons, it has been determined that a temporary bridge is not economical or environmentally friendly and further consideration is not warranted.

14. RECENT STUDIES

2006 HUNTER MILL ROAD TRAFFIC CALMING STUDY

The Hunter Mill Road Traffic Calming Study (HMRTCS) was published in 2006 on behalf of the Northern Virginia Transportation Authority. The goal of the HMRTCS was to develop traffic calming measures that will promote a safer flow of traffic along Hunter Mill Road and to enhance the road’s historic and cultural features.

One of the stated goals of this study is “to provide a safe and efficient two-lane roadway, keeping with the corridor’s scenic and historic character”. In order to accomplish this, the following recommendations were made:

1. Obtain a design exemption for narrower lane widths.
2. Match the existing roadway profile as closely as possible in order to reduce vehicle speed.
3. Re-route the existing “Rails to River Trail” under the proposed bridge.
4. Placement of pedestrian trails off of the roadway.
5. Installation of roundabouts on both the north and south end of the bridge.

The alternatives presented in this report are consistent with recommendations 1 and 2. The proposed lane widths will match existing, and a design exception will be pursued to use 4 ft shoulders instead of the 10 ft shoulders that are required for this classification of roadway. The vertical alignment will tie into the existing alignment as quickly as possible and will be designed to 30 mph to match existing conditions. This profile along with the reduced bridge width will help reduce vehicle speeds and maintain the historic character of Hunter Mill Road.

As discussed in Section 8, the alternatives investigated in this study are consistent with the requirements of VDOT IIM-S&B-95, which establishes project eligibility, payment limits and eligible items of work for Structurally Deficient bridge projects using State of Good Repair (SGR) funding. In accordance with IIM-S&B-95, the extra costs associated with widening the bridge to accommodate pedestrian facilities and the costs associated with increasing the height and length of the bridge to accommodate an equestrian trail are not eligible for SGR funding.
This work does not meet the purpose and need of this project which is to address the structural deficiencies of the existing bridge.

IIM-S&B-95 also states that any permanent work located beyond the project touchdown points is not eligible for SGR funding. This includes significant traffic calming measures such as roundabouts. Less expensive traffic calming measures could be considered within the project touchdown points, such as a speed bump near the existing trail crossing.

**2017 HUNTER MILL ROAD CORRIDOR ANALYSIS REPORT**

The Hunter Mill Road Corridor Analysis Report was published in March, 2017. This study focused mainly on the realignment of Sunset Hill Road and the intersection of the new alignment with Hunter Mill Road. All of the proposed improvements presented in this study occur approximately one mile south of the Colvin Run Bridge and are not anticipated to affect the bridge replacement project.
## 15. REPLACEMENT ALTERNATIVE PROS & CONS

<table>
<thead>
<tr>
<th></th>
<th><strong>Pros</strong></th>
<th><strong>Cons</strong></th>
</tr>
</thead>
</table>
| **Replacement with Two-Lane Bridge / Detour** | ➢ Lowest project cost  
➢ Shortest construction duration  
➢ Proposed two-lane bridge dramatically improves roadway geometrics, functionality, and safety over the current one-lane configuration | ➢ Requires a lengthy detour in both directions |
| **Replacement with Two-Lane Bridge / Phased Construction** | ➢ Maintains one alternating lane of traffic throughout construction  
➢ Proposed two-lane bridge dramatically improves roadway geometrics, functionality, and safety over the current one-lane configuration | ➢ Highest overall cost  
➢ Longest construction duration |
## 16. PROJECT SUMMARY

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Estimated Construction Duration (months)</th>
<th>Estimated Bridge Cost (Appendix A)</th>
<th>Estimated Roadway Cost</th>
<th>Estimated Utility and R/W Cost</th>
<th>Estimated CEI Cost (20%)</th>
<th>Estimated Contingency (20%)</th>
<th>Estimated Total Project Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement with Two-Lane Bridge / Detour</td>
<td>8</td>
<td>$999,500</td>
<td>$360,000</td>
<td>$33,000</td>
<td>$271,900</td>
<td>$271,900</td>
<td>$1,936,300</td>
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<tr>
<td>Replacement with Two-Lane Bridge / Phased Construction</td>
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<td>$408,300</td>
<td>$33,000</td>
<td>$338,720</td>
<td>$338,720</td>
<td>$2,404,040</td>
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</tbody>
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Notes: Assumed construction duration is form time of mobilization to project completion. It is assumed that there are no time of year restrictions. Estimated costs associated with right of way acquisition and utility relocation are estimated using PCES. For detailed bridge cost estimates, see Appendix A.
17. RECOMMENDATION

The recommended option to address the structural deficiency of the Route 647 (Hunter Mill Road) over Colvin Run Bridge is to replace it with a two-lane structure using phased construction.

The additional bridge width allows traffic to be maintained throughout construction without requiring a lengthy detour or temporary bridge. This reduces traffic impacts while avoiding significant adverse environmental, utility, and right of way impacts. A two-lane bridge significantly improves the functionality and safety of the permanent facility, ensuring that the upfront investment has the highest long-term benefit to the travelling public.

A one-lane bridge is not appropriate for this location because the current and future traffic volumes far exceed the typical limit for which a design waiver would be approved. The proposed two-lane configuration will match the existing approach roadways, and the site will remain in character with this portion of Hunter Mill Road.
APPENDIX A
Bridge Cost Estimates
## Two Lane Bridge with Phased Construction Estimate

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of Existing Structure</td>
<td>1</td>
<td>LS</td>
<td>$50,000.00</td>
<td>$50,000.00</td>
</tr>
<tr>
<td>Environmental and Worker Protection</td>
<td>1</td>
<td>LS</td>
<td>$8,000.00</td>
<td>$8,000.00</td>
</tr>
<tr>
<td>Disposal of Material</td>
<td>1</td>
<td>LS</td>
<td>$10,000.00</td>
<td>$10,000.00</td>
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<tr>
<td>Cofferdam</td>
<td>2</td>
<td>EA</td>
<td>$20,000.00</td>
<td>$40,000.00</td>
</tr>
</tbody>
</table>

**Superstructure:**

- Concrete Class A4: 30.6 CY @ $860.00 = $26,316.00
- Corrosion Resistant Reinforcing Steel, Class II: 3538 LBS @ $2.54 = $8,986.52
- Prestressed Concrete Slab, 3' x 15" x (+35' - 40') EA @ $15,000.00 = $165,000.00
- Bridge Deck Grooving: 136 SY @ $20.00 = $2,720.00
- Railing, Kansas Corral 32", w/out curb: 88 LF @ $250.00 = $22,000.00
- Architectural Treatment: 19 SY @ $175.00 = $3,325.00

**Substructure:**

- Concrete Class A3: 226.9 CY @ $860.00 = $195,120.28
- Corrosion Resistant Reinforcing Steel, Class I: 22350 LBS @ $2.54 = $56,768.61
- Reinforcing Steel: 10077 LBS @ $1.90 = $19,146.37
- Dry Riprap Class II, 38": 403 TON @ $82.00 = $33,023.25
- Structure Excavation: 1582 CY @ $55.00 = $87,010.00
- Geocomposite Wall Drain: 194 SY @ $35.00 = $6,774.60
- Select Backfill (Abutment Zone): 2158 TON @ $45.00 = $97,112.47
- Steel Piles, 10": 1080 LF @ $65.00 = $70,200.00
- Pile Points for Steel Pile: 54 EA @ $120.00 = $6,480.00
- Architectural Treatment: 98 SY @ $175.00 = $17,150.00
- Temporary Sheet Piling: 1423 SF @ $50.00 = $71,125.00

**Modifier:** Additional 20% on base cost for phased construction $199,251.62

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity/Dimensions</th>
<th>Unit</th>
<th>Unit Cost</th>
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<tr>
<td>Bridge Subtotal</td>
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<tr>
<td>Mobilization</td>
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<td></td>
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</tr>
<tr>
<td>Bridge Total</td>
<td></td>
<td></td>
<td></td>
<td>$1,285,285</td>
</tr>
</tbody>
</table>
## Two Lane Bridge with Detour Construction Estimate

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
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---

**Bridge Subtotal** = $925,133

**Mobilization** = $74,385

**Bridge Total** = $999,518
APPENDIX B
General Plan and Elevation Exhibit
Sta. 106+52.00  
Beginning of bridge  
Sta. 106+52.00  
Abutment A

Elev. 232.97  
Existing profile  
Face of rail  
Face of rail  

V. 40'-0"  
Edge of stream

Sta. 106+92.00  
End of slab  
End of bridge

V.C. = 150.00'  
C.G. Elev. 234.00  
-1.73 %

FOR CONSTRUCTION see Sheet 2.