Stage I Bridge Report Summary Form

Project Name: ***Belmont Bridge Replacement*** Date: ***04-05-2018***

Fed Structure ID (New): ***31086*** UPC: ***75878***

Fed Structure ID (Exist): ***20087***

State Project Number: ***0020-104-101, B601***

City of: ***Charlottesville*** District: ***Culpeper***

Facility Carried: ***9th Street/ Route 20*** Over: ***Avon St., Buckingham Branch Railroad & Water St.***

☒ This project is programmed for Federal Aid. Funding Source: ***Federal***

Federal Project Number: ***BR-5104 (159)*** Federal Oversight ***NFO***

Prepared for the

City of Charlottesville

Jeanette Janiczek, UCI Program Manager (434) 970-3309

Submitted by

Kimley-Horn (804) 673-3882

Recommended Bridge Structural Summary:

Superstructure:	Type: Prestressed concrete 45” deep bulb-T beams Units: One unit, continuous for live load Span Layout: 57’ – 7 1/8” -- 89’ – 11 5/8” -- 88’ – 3 7/8” Skew angle: Varies Material: Prestressed concrete Roadway cross-section: Two (2) travel lanes = 11’ – 0”, Two (2) medians = 3’ – 0”, Two (2) bike lanes = 7’ – 0”, Two (2) sidewalks = 10’ – 0” Roadway width: 62’ – 0” face-to-face of barriers Parapet or Rail Type: Modified BR27C, 42” high, Test Level TL-3 Bridge Surface Width: 63’ – 8” Joint Type(s): Structure will be jointless. Structure meets requirements for a jointless structure shown in VDOT Structure and Bridge Manual Part 2, Chapter 17. A Design Waiver is not required. Deck width meets limitations in I&IM 80, a longitudinal joint is not required. A Design Waiver is not required
Substructure:	Proposed Abutment A Type - Fully Integral Proposed Abutment B Type - Fully Integral Proposed Pier Type(s) – Multi-Column Piers (see Appendix A for renderings) Piers will not be designed for collision. Pier protection is required. Proposed Foundation: Spread footings at each pier, pile footings at abutments.
Clearances:	Minimum Vertical Clearance: - 23’ – 0” (CSX Railroad), 20’ – 9⅝” (Avon St.), 20’ – 10⅛” (Water St.) Minimum Horizontal Clearance: - 1 ‘ -6” (Pier 1 to Avon St.), 23’ – 5¼” (Pier 1 to CSX RR), 26’ – 4 5/8” (Pier 2 to CSX RR), 12’ – 8” (Pier 2 to Water St.) ☒Bridge crosses Railroad track(s). Geometry does not allow for additional tracks or maintenance roads.
Preliminary Hydraulic Analysis:	Freeboard above design flood: N/A If 100 year storm floods bridge include: N/A Return period of roadway flood event: N/A Scour at this location N/A. Scour is not expected to effect foundation design. A Design Waiver is not required

Recommended Bridge Cost Summary:

Estimated Costs:	Estimated cost of recommended layout - $ 4,850,000 Ratio of recommended layout to lowest cost alternative considered: 1.0 Cost/SF this layout: $322.79 Estimate is based on: Preliminary quantities The detailed cost estimate ***is*** included with the supplemental data. This recommendation ***is*** the lowest cost bridge solution. Estimated cost does not include preliminary engineering. Construction engineering and contingencies are not included.

*For estimated cost of alternative layouts see Bridge Alternative forms

Bridge Alternatives Developed:

☒ Bridge Alternative forms are attached

☒ Bridge Alternatives are presented in a Narrative Appendix

Special Construction Considerations:

Aesthetics – Required (see Appendix A for renderings)

- Aesthetics will include pedestrian lighting on and under the bridge, a special design railing and fence (if required), form liner at the abutments and MSE walls, and non-standard pier column configurations

Stage Construction – Required

Lighting on bridge – Required

Roadway Coordination Data Summary

☒Data not shown is provided on roadway plans provided as supplementary data

Recommended structure will not be functionally obsolete.

Based on Roadway Plans dated: 03/08/2018

On Bridge

Current ADT(year):	*14,000 (2016)*	Design ADT(year):	*14,700 (2041)*
% Trucks: *3%*	Design Speed: *25 mph*	Posted Speed:	*25 mph*
Reduced Design Speed (if applicable)	*N/A*	Is the road carried on the NHS?	*No*
Functional Classification:	*Minor Arterial*	Min. Design Standard:	*GS-6*
Existing Dimensions	*Face-to-face of rails = varies*	Proposed Dimensions	*Face-to-face of rails = 62' – 0"*
Max Grade	*5.38%*	Profile type	*Hump vert. curve*

Under Bridge: Old Avon Street

Current ADT(year):	*250 (2016)*	Design ADT(year):	*300 (2041)*
% Trucks: *0%*	Design Speed: *25 mph*	Posted Speed:	*25 mph*
Reduced Design Speed (if applicable)	*N/A*	Is the road under on the NHS?	*No*
Functional Classification:	*Local*	Min. Design Standard:	*GS-8*
Existing Dimensions	*Varies; Min = 30', Max = 36'*	Proposed Dimensions	
Max Grade	*-1.04%*	Profile type	*Hump vert. curve*

Under Bridge: Water Street

Current ADT(year):	*5200 (2016)*	Design ADT(year):	*5500 (2041)*
% Trucks:	*3%*	Design Speed:	*25 mph*
Posted Speed:	*25 mph*		
Reduced Design Speed (if applicable)	*N/A*	Is the road under on the NHS?	*No*
Functional Classification:	*Major collector*	Min. Design Standard:	*GS-7*
Existing Dimensions	*Varies; Min = 26', Max = 33'*	Proposed Dimensions	
Max Grade	*0.50%*	Profile type	*Straight*

The geometrics of the road approaching the structure include the position and alignment of the approach guardrail, if applicable. When bridge is an overpass, then lateral clearances beneath the structure constitute part of the control geometrics and must be shown.

Recommended Bridge Geometrics Summary:

Geometrics:

This project must meet

☐ Low Volume Road Standards

☐ RRR Stds

☐ VDOT Road Design Manual and AASHTO Green Book

☒ AASHTO Green Book only (First Cities)

☐ PM 100 attached ☐ Scoping Report in IPM ☐ Current Road Plans in IPM

Roadway width conforms to VDOT Structure and Bridge Manual, Part 2 Chapter 6 File No. 06.02-07 which controls the design.

A Design Waiver is not required.

☒ Roadway includes provisions for bicycles, a 42” TL-3 crashed tested railing has been provided.

A Design Waiver is not required.

☒ Pedestrian facilities are included:

Sidewalk requirements from VDOT Structure and Bridge Manual, Part 2 Chapter 6 are met; a 42” TL-3 crashed tested railing has been provided.

A Design Waiver is not required.

☒ Bridge is on horizontal curve or within 200ft of PC/PT:

Stopping sight distances meet requirements of VDOT Structure and Bridge Manual, Part 2 Chapter 6.

A Design Exception is not required.

Data Sources:

Data from the following sources was considered in the development of this report

Environmental Sources								
☒	CE	☐	EA	☐	EIS	☐	other	

L&D Sources	
☒	Roadway Design Plans (03/08/2018)
☒	Traffic Engineering Reports
Surveys	
☒	Bridge Situation Plan
☒	Topographic survey and bathymetric/hydraulic datum references
☒	Other survey information (scour, utility, etc.)
☐	Hydraulics/Hydrology
Bridge Sources	
☒	Existing Bridge Plans (Structure Number 20087 (federal number), Plan Number 158-16, Year Built 1961)
☒	Existing Bridge Inspection Report(s)
☐	Other
Geotechnical sources	
☒	Existing Geotechnical Information (From project site, nearby bridges, roadway borings, geologic maps, etc.)
☒	Project Specific Geotechnical
Meeting(s) (Localities, District, Residency, etc.) (dates on for these are critical)	
☒	Localities
☐	District
☐	Residency
☐	Other
Other Sources	
☐	FHWA Recommendation (Rehabilitation vs. Replacement)
☒	Site Visit
☐	Other
☐	

Approval of Recommended Bridge:

Project Name: ***Belmont Bridge Replacement*** Date: ***03/08/2018***

Fed Structure ID: ***20087 (exist.); 31086 (prop.)*** UPC: ***75878*** Federal Oversight: NFO

State Project Number: ***0020-104-101*** Federal Project Number: ***BR-5104 (159)***

City: ***Charlottesville*** District: ***Culpeper*** Funding Source: ***Federal***

Facility Carried: ***9th Street / Route 20*** Over: ***Avon St., Buckingham Branch Railroad, Water St.***

Recommended for Approval By:

Jeanette Janiczek
Urban Construction Initiative Program Manager

Date:

Remarks:

Approved:

Date:

Remarks:

Approval not Required::

Date:

Remarks:

Approval not Required:

Date:

FHWA Virginia Division Bridge Engineer

Remarks:

PROJECT REPORT

UPC: 75878

DATE: 4/5/2018

Table of Contents

1.0 INTRODUCTION

Belmont Bridge, on 9th Street/Route 20, in the City of Charlottesville is an existing four-lane, seven-span steel girder bridge with a longitudinal joint along its centerline, creating two separate structures. While the existing bridge contains four lanes, only three lanes act as through lanes with one southbound lane acting as two left turn lanes. The bridge spans over both Old Avon Street and Water Street, as well as Buckingham Branch Railroad. The rail line is owned by CSX Transportation, but is operated by Buckingham Branch. In its current state, it has a sidewalk on each side to accommodate pedestrian traffic and a median with a longitudinal joint along the centerline. The eastern sidewalk on the existing bridge is currently closed to pedestrians due to safety concerns.

The bridge, based on the inspection report from September 2016, is in overall poor condition and is classified as structurally deficient. The poor condition indicates that the structure has advanced section loss and some deterioration, which is confirmed in the inspection report. Per the inspection report and the VDOT Bridge Condition Key, the deck and superstructure are both rated as a 4 (out of 9). A condition rating of 4 or below, for any of the deck, superstructure or substructure makes the bridge structurally deficient. As a result, the City of Charlottesville has determined it is more cost efficient to replace the bridge with a new structure rather than replace the deck and superstructure on an aged substructure (with a current rating of 5).

The intent of the replacement is to provide a new structure to replace the structurally deficient Belmont Bridge. The bridge serves as the primary access to downtown Charlottesville from Interstate 64 and is an important link between four neighborhoods, the Downtown Mall and Pavilion, and the neighboring County of Albemarle. This report contains the background information of the existing bridge and the results and recommendations based on the conceptual and preliminary design performed to date. Reasonable bridge alternatives were considered for this project and ultimately, the recommended alternative best meets the requirements for the replacement of this bridge.

A separate Stage I report will be prepared for Structure B602 (the “knuckle”) at a later date for the City to review.

1.1 AUTHORITY

This study was authorized by the City of Charlottesville as part of the design services agreement, for the replacement of the Belmont Bridge, State Project No. 0020-104-101. The City of Charlottesville project manager is Jeanette Janiczek, who can be reached at (434) 970-3309 or at Janiczek@charlottesville.org

1.2 PROJECT PURPOSE

The purpose of this project is to provide a complete replacement for the deteriorating bridge on 9th Street / Route 20. The structure is in an advanced stage of deterioration and carries a significant amount of pedestrian and vehicular traffic. Due to the condition and importance of the bridge, it is imperative that the bridge is replaced before the condition of the bridge declines further.

1.3 STRUCTURE SCOPE

Develop alternatives to replace the existing steel bridge and provide professional engineering services for the design of the proposed bridge.

1.4 ROADWAY INFORMATION

The functional classification of the primary route is a Minor Arterial. The Average Daily Traffic (ADT) is 14,000, as of 2016, with 3% heavy vehicles. The design ADT is 14,700 in year 2041. The proposed design speed for this site is 25 miles per hour.

1.5 ROADWAY GEOMETRY

Two lanes of traffic, one in each direction, will be maintained during bridge sequence of construction stages one, two and four; during stage three, overnight construction and flaggers will be used to accommodate a single lane of traffic while the concrete median is being poured. Additionally, pedestrian connectivity will be maintained during all phases of construction. To accommodate the required construction staging the existing bridge will be demolished about its centerline, which is also the centerline of the longitudinal joint between the two structures. The east section will be demolished first, with the west section accommodating both traffic flows. During this time, the new structure will be constructed along the east side; the centerline of the new structure will be offset from the centerline of the existing structure by a minimum of 8'-0" in order to provide room for demolition and construction activities and to accommodate the necessary construction staging. Once all requirements for the east section have been met, the west section of the existing bridge will be demolished and all traffic will be accommodated on the east section of the new bridge. During this time, the west section of the new bridge will be constructed. Once finalized, the bridge will be open to all traffic as intended – including the 7'-0" wide bike lanes and 3'-0" wide medians.

This portion of 9th Street is in both horizontal and vertical curves. The proposed roadway profile includes a crest vertical curve, with a 5.38% and a -4.20% grade. There is a horizontal curve on the bridge, which is a compound curve with radii of 2000' and 1335', respectively.

2.0 DATA SOURCES

- Existing bridge inspection report (September 2016)
- Survey Information (February 2017)
- Existing Bridge Rating
- Existing bridge plans (October 1960)
- VDOT Traffic Study
- Traffic Data (2016)
- Roadway Design Plans (March 2018)
- Stage I Geotechnical Report (April 2017)
- Hazardous Materials Report (March 2018)

2.1 DESIGN CRITERIA

The following is a list of the design criteria and resources used to generate the Stage I report:

- AASHTO LRFD Bridge Design Specifications, 7th edition, with 2015 and 2016 interims
- VDOT Modifications to AASHTO LRFD Bridge Design Specifications (IIM-S&B-80.5)
- VDOT Manual of the Structure and Bridge Division (Part 2)
- VDOT Road and Bridge Specifications (2016)
- VDOT Road and Bridge Standards (2016)
- Public Right-of-Way Accessibility Guidelines (PROWAG) (2011)
- City of Charlottesville City Standards and Design Manual, current edition
- NACTO Urban Street Design Guide, current edition
- NACTO Urban Bikeway Design Guide, current edition
- CSX Public Project Manual, July 2017

In addition, the following software was used to complete this report:

- LEAP Bridge Concrete
- AutoCAD
- Mathcad

3.0 SITE DESCRIPTION

This bridge is on a Minor Arterial Road. The existing bridge is a four lane, seven-span, 452-foot long steel girder structure. While the existing bridge contains four lanes, only three lanes act as through lanes with one southbound lane acting as two left turn lanes. The existing foundation is a combination of spread footings and piles. There are numerous businesses and local attractions that are adjacent to the bridge. In addition, there is a City Transit Center located near the project on Water Street.

The existing bridge currently spans over Avon Street, Buckingham Branch Railroad, Water Street and a parking lot. The proposed bridge will be significantly shorter than the existing, at 237 feet long compared to 452 feet, respectively. The removal of parking underneath the bridge and use of fill segments and MSE walls at the south approach allowed for a significant reduction in bridge length.

It is anticipated that a modification to the existing railroad easement will be required for the new bridge alignment and for construction staging. The new easement will also need to allow for both of the pier footings to be placed inside the railroad Right-of-Way. In addition, temporary construction easements will be required for the construction of both piers – though the columns of the piers will be outside of railroad Right-of-Way.

The existing bridge has a sidewalk on both sides of the bridge, although the east side sidewalk is closed due to safety concerns that will be remedied with the bridge replacement project. Throughout construction it is necessary to provide pedestrian access on the bridge over the railroad tracks during all stages.

There are several public utilities which will need to be relocated and/or improved during construction. The utility issues are discussed in more detail in Section 3.3 of this report.

3.1 PROJECT LOCATION

The project is located on 9th Street / Route 20, in the City of Charlottesville, between Levy Avenue and East Market Street. It is in VDOTs Culpeper District, but is maintained by the City of Charlottesville.

3.2 GEOTECHNICAL DESCRIPTION

Based on the Stage I Geotechnical Report prepared by Schnabel Engineering, dated April 6, 2017, there are no known faults at this project site. The existing structure was constructed using a combination of piles and spread footings. Based on the material found during the boring investigation for the Stage I geotechnical report, it was recommended that integral abutments be supported using piles, with the piers being supported by spread footings.

3.3 UTILITY ISSUES

The existing bridge has numerous utilities running through and alongside the project. An existing underground electrical line is near Abutment A (south abutment) and will need to be relocated. An existing 8” water line in Avon Street will remain. Two unknown utilities are in close proximity to Pier 1, but limited information is available. It is anticipated that they will be removed or relocated during construction. No utilities (except power for pedestrian lights and light poles) – existing or proposed – are expected to be carried on the bridge at this time.

3.4 TRAFFIC ENGINEERING ISSUES

9th Street is a critical transportation link in the City of Charlottesville, and no acceptable detours were identified with sufficient capacity to accommodate additional traffic under a full traffic closure. Therefore, staged bridge construction was the only option supported by the City and public.

The project will be constructed in four phases. The first phase will include the demolition of the east side of the existing structure (along the centerline of the existing bridge) and moving all vehicular and pedestrian traffic to the west side of the existing bridge. Once all traffic has been shifted, the eastern portion of the proposed bridge will be constructed, excluding the eastern median and sidewalk. Once this phase is completed, stage two can start with traffic being shifted to the new structure while the western portion of the existing bridge is demolished. The proposed western portion of the new bridge will then be constructed in its entirety, including the western median and sidewalk. After completion of the second stage, stage three construction can begin, which requires shifting traffic to the western portion of the structure. Using overnight construction, flaggers, and one-way traffic on the western portion of the bridge, the eastern median will be poured. Finally, during the fourth stage, all traffic will be shifted to its respective final location while the eastern sidewalk is poured. For more detail refer to the attached preliminary bridge plans.

Pedestrian access must be provided through the construction of the new bridge replacement, since the bridge crosses three sets of active railroad tracks in addition to Avon and Water streets. The existing bridge serves as the only means of pedestrian access across the existing railroad tracks in this area of the City. A pedestrian detour is not feasible at this location due to the high concentration of pedestrian generators such as the Sprint Pavilion, Pedestrian Mall and surrounding neighborhoods and the barrier of the active rail lines.

3.5 ENVIRONMENTAL ISSUES

Lead based paint was detected on the existing structure, therefore the existing structure will need to be disposed of properly. Asbestos testing was not performed; however, based on the construction date of the existing bridge, it is likely present and should be considered. The existing soil maybe contaminated and if above legal limits it should be hauled offsite and disposed of properly.

3.6 DRAINAGE ISSUES

No bridge deck drainage is required for the proposed bridge. All bridge drainage will be handled by inlets at the beginning and end of the bridge. For more specifics on the proposed drainage in the vicinity of the bridge, see the roadway plans.

3.7 RAILROAD ISSUES

The proposed bridge will span over three Buckingham Branch Railroad tracks. At the request of these operators, the minimum vertical clearance will be provided. These clearances follow the VDOT Structure and Bridge Manual.

Pier 1 does not meet the minimum requirements for lateral clearance from the railroad. As such, Pier 1 will require a crash wall to protect it from potential impacts.

Due to the proximity of both piers to Old Avon and Water streets and the railroad tracks and the expected bottom of footing elevations of both piers, it is expected that a combination of temporary and permanent shoring will be required for pier construction. Temporary shoring will be required within both Old Avon and Water streets, with permanent shoring required within the railroad Right-of-Way based on CSX Railroad's Public Project Information Manual.

While it is understood that CSX guidelines require a fence for a structure supporting pedestrian traffic that crosses active rail lines, it is the intent to request a variance from CSX to not install a fence on the proposed bridge now. However, a special design aesthetic fence will be designed as a part of this project, and since the parapet and railing on the proposed bridge will be detailed to accommodate a fence, the special design fence can be installed later should the need arise. See Appendix A for renderings of the special design fence.

3.8 CONSTRUCTABILITY ISSUES

The project will be constructed in four phases. The first phase will include the demolition of the east side of the existing structure (along the centerline of the existing bridge) and moving all vehicular and pedestrian traffic to the west side of the existing bridge. Once all traffic has been shifted, the eastern portion of the proposed bridge will be constructed, excluding the eastern median and sidewalk. Once this phase is completed, stage two can start with traffic being shifted to the new structure while the western portion of the existing bridge is demolished. The proposed western portion of the new bridge will then be constructed in its entirety, including the western median and sidewalk. After completion of the second stage, stage three construction can begin, which requires shifting traffic to the western portion of the structure. Using overnight construction, flaggers, and one-way traffic on the western portion of the bridge, the eastern median will be poured. Finally, during the fourth stage, all traffic will be shifted to its respective final location while the eastern sidewalk is poured. For more detail refer to the attached preliminary bridge plans.

There are numerous overhead and underground utilities in various directions near the bridge. The Contractor will need to be cautious of all utilities above and below the bridge during all phases of construction.

There is an existing easement on the Right-of-Way of the railroad. Due to the close proximity of Old Avon Street and the use of spread footings at Pier 1, an easement will be needed to construct Pier 1. Access under the existing and proposed bridge will need to be coordinated with the City and Buckingham Branch Railroad.

To construct the pier footings, excavations will be required. Due to the proximity of both piers to Old Avon and Water streets and the railroad tracks and the expected bottom of footing elevations of both piers, it is expected that a combination of temporary and permanent shoring will be required for pier construction. Temporary shoring will be required within both Old Avon and Water streets, with permanent shoring required within the railroad Right-of-Way based on CSX Railroad's Public Project Information Manual. Access must be maintained along Old Avon Street to serve local businesses and along Water Street to serve the City's Central Transit Station.

3.9 AESTHETIC CONSIDERATIONS

Due to the high number of pedestrians, the urban nature of the project and its location within and adjacent to two historic districts, as well as numerous historic resources, it is the intent of the City to incorporate aesthetic details for the bridge. These details will include pedestrian lighting both on the bridge as well as beneath the bridge. The pedestrian lighting on the bridge will consist of light poles mounted to the bridge deck, light recessed into the parapets, and handrail lights incorporated into the special design railing. In addition to these aesthetics, the concrete for the sidewalk, median, parapet and deck slab will be colored "Omaha Tan" per the City of Charlottesville Standards and Design Manual. The City and Kimley-Horn will evaluate adding this color finish to other concrete elements as well, including the girders and substructure.

Other aesthetic features include a special design railing installed on top of the standard BR27C parapet; additionally, as mentioned in Section 3.7 of this report, a special design fence for use on the bridge will be detailed should it be required in the future. Form liners will be specified for use at the abutments as well as the MSE wall approaches, and the piers will be designed and detailed using a non-standard column configuration to achieve a more open and visually appealing appearance. Refer to Appendix A for renderings and images of the aesthetic details to be incorporated.

4.0 BRIDGE CROSS-SECTION

The bridge cross-section consists of eight (8) prestressed 45" deep Bulb-T girders, with an 8½" deck. The face-to-face width between barriers is 62' – 0". Of this, there will be: two (2) 11' – 0" travel lanes, two (2) 3' – 0" medians, two (2) 7' – 0" bike lanes and two (2) 10' – 0" sidewalks. The total width, out-to-out, of the bridge is 63' – 8". The railings provided will meet VDOT's Structure and Bridge Manual, Part 2, Chapter 25. The bridge will consist of 8 girders, spaced at 8' – 3". Due to the curvature of the roadway alignment and the chorded girders, the overhang distance will vary along the bridge.

5.0 PRELIMINARY ALTERNATIVES

Kimley-Horn and the City of Charlottesville conducted a series of public meetings, online outreach and stakeholder engagement to develop a conceptual design for the Belmont Bridge Replacement project. Engagement activities began in February 2017 and lasted through October 2017. This engagement activity not only focused on the design of the bridge replacement, but also the context into which the bridge sits in

Downtown Charlottesville. In March of 2017, the project's City Council appointed citizen Steering Committee and the city staff Technical Committee made the determination to require staged construction of the bridge replacement, because of the need for maintenance of vehicular and pedestrian access from the south to the north and north to south across the Buckingham Branch Railroad. Further, based on prior public engagement efforts, City Council had endorsed a baseline set of metrics for the replacement of the Belmont Bridge that established that the bridge should consist of two travel lanes (11' wide), two bike lanes (10' wide), and two pedestrian sidewalks (10' wide). The baseline set of metrics was evaluated by Kimley-Horn, the Steering Committee and the Technical Committee and was shown to be achievable and supported by traffic operations and analysis. The Steering Committee, Technical Committee and the City's Bike and Pedestrian Advisory Committee helped develop a bridge cross section that provided safe, efficient and equitable space for vehicular, pedestrian and bicycle users. While function contributed to the design of the bridge cross section, the decision to maintain two way vehicular and pedestrian access across the Buckingham Branch Railroad established a minimum cross section width for maintenance of traffic of approximately 31 feet to center. The range of bridge cross sections explored for the design of the replacement bridge is in Appendix B.

One of the other critical alternatives analysis developed for the replacement of the Belmont Bridge involved bridge length. When City Council established the baseline set of metrics for the replacement bridge, City Council opened the possibility of shortening the bridge to minimize cost and free up project funds for other context sensitive purposes and aesthetic enhancements. The Kimley-Horn team developed three conceptual alternatives (depicted in the Appendix) for the bridge length. The alternatives ranged from a short bridge concept (approximately 240 LF), a medium bridge (approximately 300 LF), and a long bridge concept (approximately 400 LF). The longer bridge concepts would provide for public surface parking beneath the bridge (like the existing condition), while the shorter bridge concept eliminated some of the space available for public parking. These concepts were presented to the project's Steering and Technical Committee's with approximate square footage costs, and both the Steering and Technical Committee's endorsed the shorter bridge concept with the understanding that the cost savings of the shorter bridge would allow for further investment in context sensitive solutions and aesthetic enhancements; additionally, the City could not justify the cost of lengthening the structure to replace the parking, and the City preferred the aesthetic of a shortened bridge, provided it could replicate the current functionality of the existing bridge, while also improving connectivity. Sketches depicting the conceptual alternatives are shown in Appendix B.

There were two alternatives considered for this report. The alternatives are presented below, along with the description and cost of each.

Alternative	**Span details**	**Structure type**	**Cost**
1 (short concept)	3 span, 58' – 90' – 88'	Prestressed Bulb-T's	$4,850,000
2 (medium concept)	2 span, 150' – 150'	Steel Plate Girders	$6,040,000

6.0 BRIDGE PRELIMINARY RECOMMENDATION

It is recommended that Alternative 1 be selected. Alternative 1 provides some very favorable benefits over Alternative 2, which include:

- Lower initial cost
- Lower lifetime maintenance and long-term durability
    - Alternative 1 provides jointless construction for the bridge.
    - Alternative 2 could possibly use jointless construction, by using a deck slab extension at both abutments. However, alternative 2 is at is at the upper threshold for bridge length, per section 17.01-12 of VDOTs manual. In addition, the total movement at the abutment may exceed 1½", which would then require joints at the abutments. If joints are required, it would be a long-term maintenance issue.
- Faster construction
- Both alternatives may require shipping permits, however Alternative 2 will require a bolted field splice. This will delay the placing of the girders, and ultimately slow down construction.

The preliminary estimated construction cost of the recommended alternative is $4,850,000. This cost does not include engineering costs or contingencies.

7.0 ENGINEER'S COST ESTIMATE FOR EACH ALTERNATIVE

8.0 RECOMMENDED ALTERNATIVE BRIDGE PRELIMINARY PLANS

9.0 APPENDIX A

10.0 APPENDIX B