DESIGN EXECUTIVE SUMMARY

County:	Logan	**Item #:**	03-10010.00
Route Number(s):	US 79	**State Program #:**	9484301D
BMP/EMP:	4.35 to 4.85	**Federal Project #:**	STP 079 1006
Type of Work:	Bridge Replacement	**State Project #:**	FD52 071 0079 004-005

Highway Plan Project Description: IMPROVE SAFETY AND BRIDGE CONDITION ON WHIPPORWILL CREEK BRIDGE NEAR KY-1151.

EXISTING CONDITIONS

ADT (current): 3243 (2017) **Truck Class:** AAA **Trucks:** 19.4 %

Existing Functional Classification: ☐ Urban ☑ Rural — Arterial

Terrain: Rolling

Route is on (check all that apply): ☑ NHS ☐ NN ☐ Ext Wt ☐ None

Posted Speed Limit: 55 mph "or" **Statutory Speed Limit:** ☐ 35 mph (urban) ☐ 55 mph (rural)

Existing Bike Accommodations: Shared Lane **Ped:** ☐ Sidewalk ☐ Other: Shared

PROPOSED CONDITIONS

Design Functional Classification: ☐ Urban ☑ Rural — Arterial

Design ADT (year): 294 **DHV:**

Access Control: By Permit **Spacing:** 600'

CONTROLLING CRITERIA:	EXISTING CONDITIONS (Estimated based upon existing geometrics.)	AASHTO Guidance (for design speed)	Recommendation	Design Exception (check if needed for Design Speed)
Design Speed	55 MPH	Minimum: 55 MPH Selected: 55 MPH	55 MPH	☐

Note: For any remaining controlling criteria that are less than AASHTO recommended guidance: If recommended design speed is ≥ 50 mph, exceptions are needed; If recommended design speed is < 50 mph, variances are needed.

				Exception (≥ 50 mph)	Variance (< 50 mph)
Lane Width, No. of Lanes	12', 2 lanes	12' 2 lanes	12', 2 lanes	☐	☐
Shoulder Width (Minimum Usable)	2' paved	8' paved	8' paved 2' earth	☐	☐
Horiz. Curve Radius (Minimum)	2455.7'	1,060'	2,800'	☐	☐
Max. Superelev. Rate (emax= 6 %)	4.20%	6.00%	6% (4.2%) - Match Existing	☐	☐
Stopping Sight Distance (Minimum)	>495'	495'	>495'	☐	☐
Max. Grade (%)	0.00%	5.00%	0.04%	☐	☐
Normal Cross Slope (%)	2.00%	2.00%	2.00%	☐	☐
Vert. Clearance (ft.)				☐	☐

OTHER CRITERIA:

				Design Variance
Border Area (urban)	N/A	N/A	N/A	☐
Sidewalk Width, slope	N/A	N/A	N/A	☐
Bike Lane Width, slope	N/A	N/A	N/A	☐
Shared Use Path Width	N/A	N/A	N/A	☐
Other:				☐

DESIGN EXECUTIVE SUMMARY

Design Criteria Notes: Instead of using 8% super elevation max, 6% maximum table was used as the curvature for RC required to shift mainline back to existing alignment would've been too steep. The current conditions for stopping sight distance is based on the minimum required for the Design Speed, however, actual proposed sight distance may be limited to headlight distance as the grade of the roadway is nearly flat, and the radius of the curve is large.

Environmental Action: CE Level 1

Completion Date: __11-15-2020_____

☑ scheduled ☐ actual

Existing Pavement Depths: N/A

Include:

1. Typical sections, including bridges
2. Map showing project location
3. Project overview and existing conditions
4. Purpose and Need statement
5. Discussion of alternatives (including preferred and no build) with respective traffic control schemes, and environmental, utility and right-of-way impacts.
6. Discussion of Design Exceptions /Variances and mitigation strategies
7. Cost comparison table of alternatives vs. Highway Plan
8. Discussion if preferred alternate cost is >115% than highway plan
9. Discussion of clearzone
10. Consideration for bicycle and pedestrian facilities (see HDM Chapter 1500)
11. Water-related impacts summary

Submitted by Project Engineer: ☑ KYTC ☐ Consultant **Date:**

Recommended by Project Manager: **Date:**

Tier Level Approval ☐ Tier 1 ☐ Tier 2 ☑ Tier 3

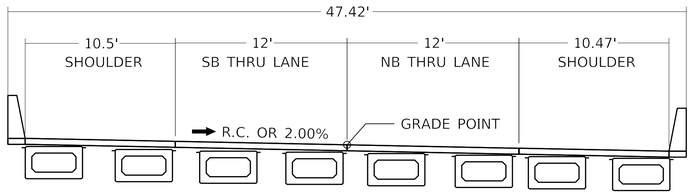
Location Engineer: **Date:**

Roadway Design Branch Manager: **Date:**

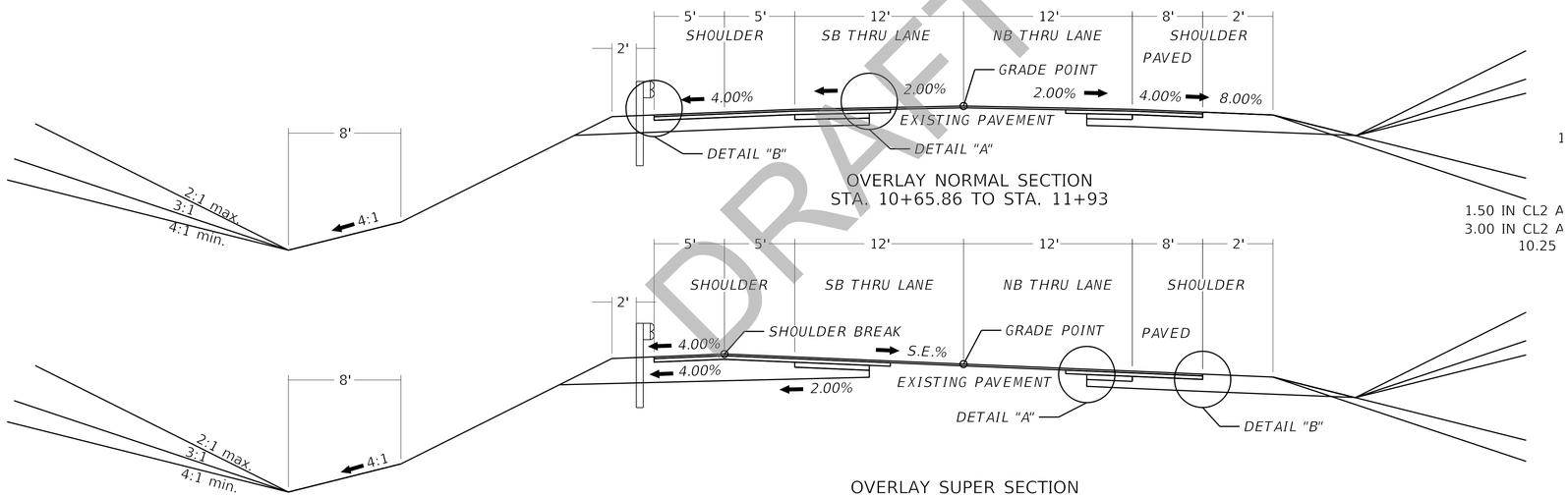
Geometric Approval Granted by: **Date:**

COUNTY OF	ITEM NO.	SHEET NO.
LOGAN	03-10010.00	R2

TYPICAL SECTION
MAINLINE US 79
CLARKSVILLE ROAD



BRIDGE TYPICAL
STA. 6+85.48 TO STA. 8+05.48



OVERLAY NORMAL SECTION
STA. 10+65.86 TO STA. 11+93

OVERLAY SUPER SECTION
STA. 2+20 TO STA. 6+25
STA. 8+65 TO STA. 10+65.86

MAINLINE US 79
OVERLAY TYPICAL SECTIONS

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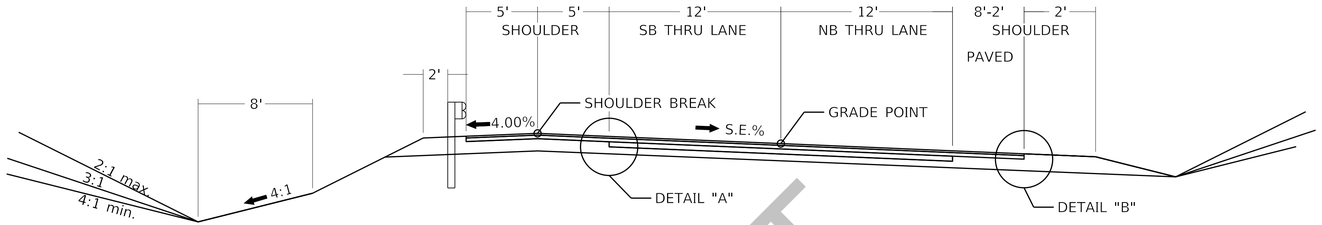
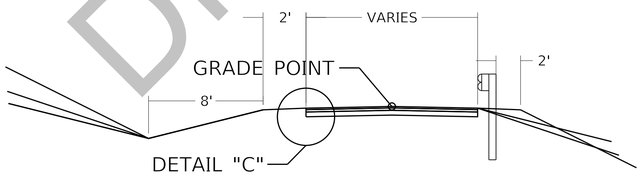
LOGAN	03-10010.00	R2A

TYPICAL SECTIONS
MAINLINE US 79
CLARKSVILLE ROAD
ENTRANCES



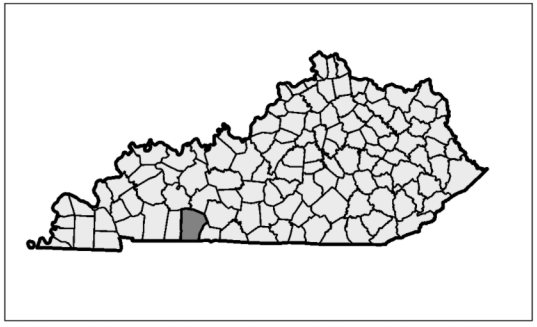
FULL DEPTH
SUPER TYPICAL SECTION
STA. 6+25 TO STA. 6+85.98
STA. 8+05.98 TO STA. 8+65

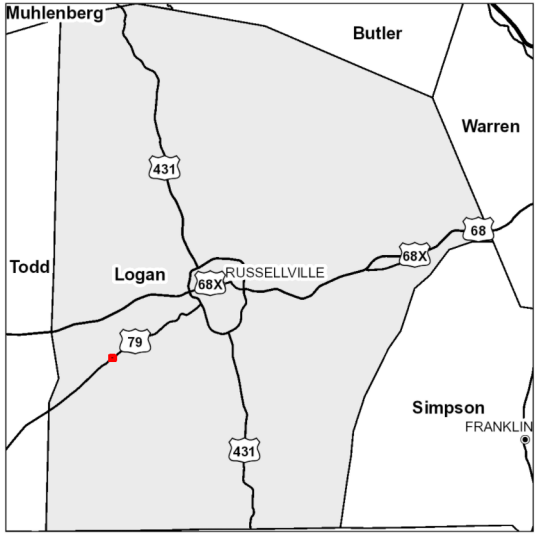


ENTRANCE SECTION

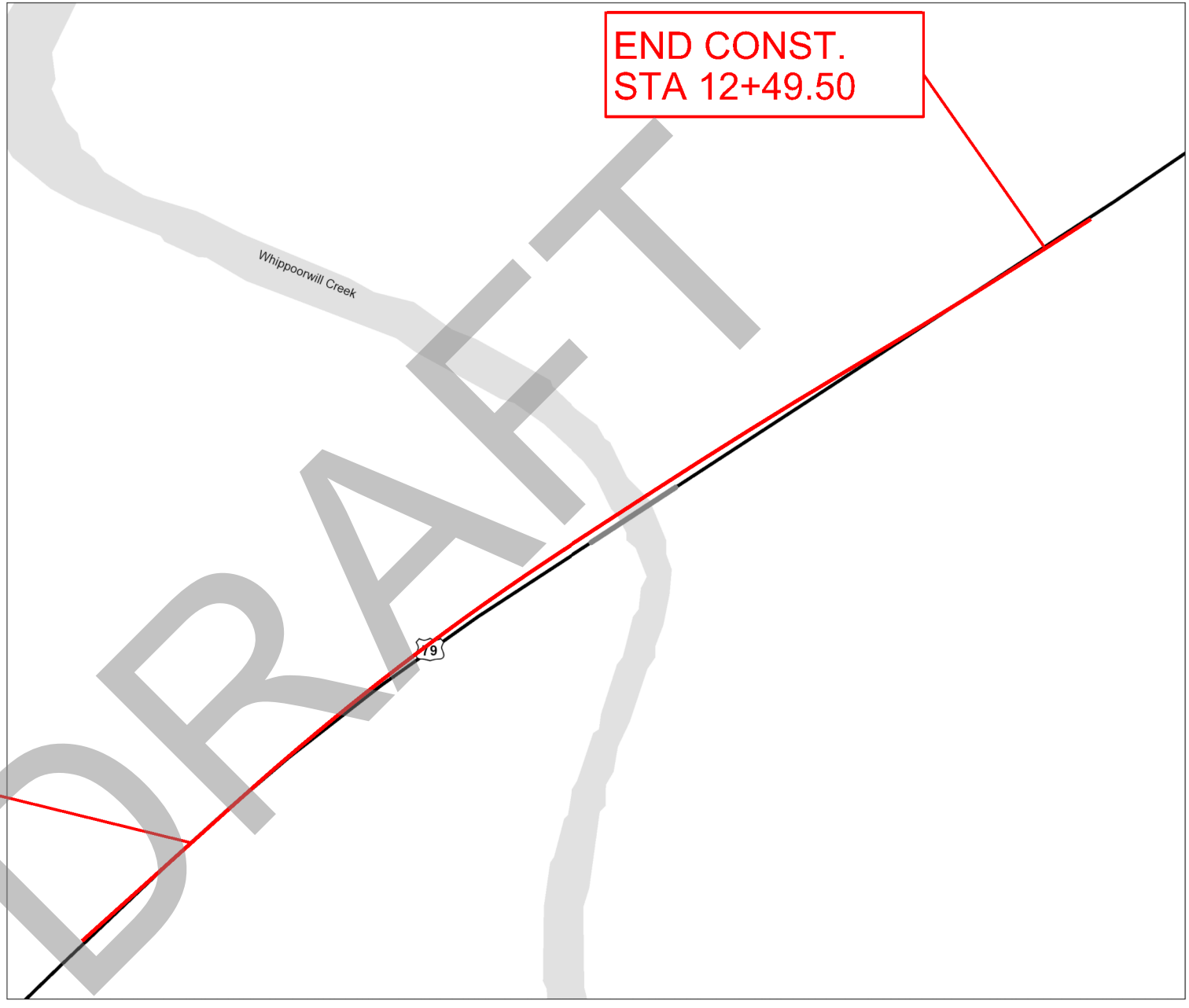
MAINLINE US 79
FULL DEPTH TYPICAL SECTIONS
ENTRANCE SECTION

FILE NAME: C:\PWWORK\ERIKA.HUBBARD\D1781426\AUXILLARY SHEETS.DGN
USER: erika.smith
DATE PLOTTED: September 7, 2005
OpenRoads Designer v10.14.4.4





BEGIN CONST.
STA 1+73.65



Project Overview

Bridge Replacement over Whippoorwill Creek US 79 Logan County is currently a two-lane roadway with 12' lanes and approximately 2' paved shoulders, rolling terrain, relatively straight horizontal geometry, and in a rural setting. This roadway is a rural major arterial for the area that is on the National Highway System with a significant percentage (19%) of truck traffic that connects Russellville, KY and Guthrie, KY. There are large level farmlands in this particular area of Kentucky, which makes for large drainage areas. In addition, because of the location of this project, the geography proves to have sinkholes that could increase the level of hydraulic analysis required. The FEMA flood hazard map also shows a house situated nearby barely out of the 100-year flood zone. Utilities on the project restrict the project further as a fiber optic line is located on the southern side of the bridge, limiting options for widening, shifting locations, or constructing diversions.

As part of a new design initiative, this project was a pilot for innovation for the Kentucky Transportation Cabinet as it adopted OpenRoads Designer. Due to this initiative, there were inadvertent delays and additional costs to the design aspect of the project as new standards were developed that could not be foreseen or controlled. Testing the software and development of workspace configurations are a key part of the process in going forward as previous roadway software will become unavailable for use in the near future. This project has been an integral part of the Kentucky's progress in joining other state department's in the future of roadway design.

Purpose and Need

In September of 2018, federal funds were set aside to improve the safety and bridge conditions on the Whippoorwill Creek Bridge on US 79 near KY 1151 in Logan County. The current bridge maintains a sufficiency rating of 75; however, due to the narrow lanes on the bridge deck, coupled with 19% of truck traffic (due to being on the National Highway System) it creates potential risks of collision. There may be issues with fog because of the stream, especially during flood events that may cause issues with sight distance. Since the roadway appears to mostly be truck traffic and local residential traffic, the local traffic will know the area fairly well. This knowledge of how narrow the bridge is combined with high truck traffic as well as recovery area could be the reason the crash history in this location is low. Otherwise, terrain and horizontal geometry do not cause any sight distance issues. The current structure has two piers located just outside the normal bank flow, however, during high rainfall events these piers pose as issues as debris may be trapped under the bridge and could cause damage. There is also potential for scour along the pier locations as well, which increases the amount of maintenance funds required to maintain the current structure. All of this considered the intent of this project is to ensure the flow of traffic across Whippoorwill Creek Bridge while also providing connection for Logan County residents between Russellville and Guthrie.

Discussion of Alternatives

No-Build Alternate – Maintain Current Structure

This alternate is to leave the current structure in place, do no removal or reconstruction of the structure. This will be to maintain the bridge until it becomes structurally deficient, posing risks as the weight limit to cross may require trucks to detour. This alternate is not entirely feasible, despite the structure not being structurally deficient, as it does not address the needs of the

project. The current structure is too narrow for the current high volume of truck traffic that travels this corridor.

Various Profiles for Bridge Types with Same Horizontal

Due to the constraints of the hydraulics, utilities, and constructability, it was determined that there was only one side that the alignment could be adjusted to. The fiber optic cable on the right side of the project eliminated shifting/widening to one/both sides of the bridge while the hydraulics required the low beam elevation to remain at a certain elevation. Due to this there was only one horizontal alignment developed with multiple profiles with various bridge beam and span configurations.

Single Span Options

One of the alternates attempts to span the reach without piers. Different beam types were studied in order to determine the effect on conveyance and headwater depth. The low beam elevation closely matches the existing structure. Three different beams were compared as a way to review this option: PCI Type 5, HN 48-49 and SBS 42” Box beam. These alternates would respectively raise the profile at the bridge 5’, 4’, and 4’ to maintain the low beam elevation. Hydraulically this was tested with the same opening shape (vertical wall abutments, same stream cross-sections, but without piers) and had little to no effect on the headwater elevation.

This alternate is not very feasible due to constructability. Since the grade is being raised so significantly, it would be difficult to construct the proposed structure and remove the existing structure while maintaining traffic. This would also introduce vertical curvature in a level area where the traveling public would not expect such change in roadway elevations and could cause potential safety issues, as driver expectations would not be met.

Dual Span Options

Another alternate is a dual-span arrangement using spread and SBS 27" box beams. These would raise the grade approximately 2 feet in order to maintain the low beam elevation, however is not as severe as the single span option. This would still allow for a pier to be able to trap debris, however, there would only be one instead of two, reducing the amount of clean up and maintenance required during a flood event. The removal of just a single pier compared to both had little to no effect on the headwater since the low beam elevation was maintained.

Triple Span Options

Another alternate is going back with a triple span similar to the existing structure using the beams: Spread 17” Box, or SBS 17” Box. This would not require raising the profile to maintain the low beam elevation, but would not solve any issues with piers collecting debris in the stream. The conveyance of water would be almost identical depending on the length and type of substructure required for the bridge.

Preferred Alternative

The preferred alternative was selected based on the following factors: The Maintenance of Traffic phasing being a large part in the decision making process as it could drive the cost of the structure

significantly depending on the complexity. The cost of the bridge was increased post-preliminary line and grade due to the increased complexity to account for unforeseen expenses due to the Maintenance of Traffic that would be required to finish the project. After an in-depth analysis, the final configuration is a dual span SB 27 inch beam bridge with 2:1 spill through abutments. The total span length will be 117' with one span at 49' and one span 68'. The bridge will also have a constant cross slope of 2% or reverse crown to avoid superelevation transition issues due to a curve located to the south.

Maintenance of Traffic

The construction of the proposed bridge will take place in two phases. The first phase will be to construct the first left half of the bridge and demolish the left of the existing bridge (two beams worth). This phase will maintain one lane of traffic via signal on the existing bridge. Phase 2 will be to move traffic onto the proposed structure previously build in Phase 1, then demolish the remainder of the existing bridge to construct the right half of the proposed bridge.

There was discussion between the structural branch, designer, and district office about the possibility of shifting the horizontal geometry further to allow for a simpler Maintenance of Traffic plan and a non-part width construction of the proposed structure. The minimum width to shift would be 12', or one extra lane, causing worse curvature given the project limits. This alternative would also drastically increase the amount of fill necessary to complete the project and potentially raise the construction price and negate any savings on the construction phasing. This may be alleviated by lengthening the project, increasing the area of disturbance. This additional shift would also mean additional impacts to Right-of-Way and impacts to utilities as well. This shift would have unknown affects to the length, type, and number of piers the bridge would have due to the sensitivity of the hydraulics, this is because the bridge would now be in the contraction area of the water for the existing structure. This would add another several months of back and forth of adjusting profiles, spans, bridge skews, lengths, and bottom of beam heights to perfect where the bridge would need to be. Overall, it was decided that the additional shift could have more negative impacts to the project and to keep the horizontal as is with the construction that is slightly more complex phasing even though the price was slightly higher.

Right of Way

The existing Right of Way was determined based on the existing plans for the US 79 route in Logan County in 1934. The plans provided detail, and clear indicators of where the Right of Way widened or narrowed due to the bridge. Using this information and the disturbance limits of each alternate, proposed Right of Way was set to minimize impacts to the property owners as much as possible. Temporary easements were added to provide a buffer of space to allow for construction of the project yet allowing the property owner to maintain land ownership when the project is completed. The disturbance limits were similar to all alternates as there were only differences of roadway profiles.

Utilities

The utilities in this project area include overhead utilities, underground fiber optic, and a six-inch water line. The overhead utilities are to the western side (left) of the road while the fiber optic and six-inch water line are to the eastern (right) side of the roadway. Due to the cost of disturbance of fiber optic

being so expensive, it was decided that alternates to the eastern (right) side were not feasible with the budget provided. All of the alternatives considered this and shifted/widened to the western (left) side, which will require up to possibly two to three utility poles to relocate. This was determined a fiscally feasible solution and minimally invasive as only a few poles would be affected.

Environmental

The environmental impacts are being mitigated by using standard erosion control measures such as: silt fence to protect the creek, silt checks to help collect and minimize silt before it gets to the stream, mulching as well as seeding and protection to protect bare earth from eroding. The footprint of the overall project was taken into consideration to be kept at a minimum disturbance as well as minimum disturbance to the property owners. The majority of the disturbance area is along the side slopes of the existing roadway, and within the ditch limits. There will be an initial archaeological and biological inspection to ensure that if disturbances incur to areas of importance to each respective field of study, a more rigorous analysis will be conducted for procedures to allow continuation of the project.

		Single Span		Preferred Double Span	Triple Span
		HN 48-49	PCI TY 5	SB 27	SB 17
D	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000
R	$ 150,000	$ 110,000	$ 110,000	$ 90,000	$ 100,000
U	$ 270,000	$ 120,000	$ 120,000	$ -	$ 120,000
C	$ 2,575,000	$ 1,207,000	$ 1,195,000	$ 1,774,000	$ 1,748,500
	% Diff in C Phase	-53%	-54%	-31%	-32%

Cost Discussion vs Highway Plan

The preferred alternate is within the Six Year Plan (SYP) budget (Revised SYP based on January 27, 2021). The bridge estimate is higher than normal due to the Bridging KY program, which has caused the cost of bridges to go up significantly. Another factor affecting the price is the MOT, since it is being constructed part width; it makes the construction of the bridge more difficult and therefore more expensive than normal. As mentioned previously, there is a way to simplify MOT, but it introduces more impacts and possible costs due to earthwork, possibly longer structure, ROW impacts, and utility impact. However, even with all of these constraints, it appears it may be possible to construct the project within budget.

Clear Zone Discussion

The project team recognizes that the AASHTO Roadside Design guide recommends a clear zone width of 20-22ft for slopes that are 6:1 or flatter, and 24-30ft for slopes that are 5:1 or 4:1. The project team also recognizes the impacts of such slopes can have on acquiring property, impacting streams or other habitat, impacting utilities, or other such constraints budgetary or otherwise. In order to be considerate of all of these factors, the project team chooses a typical with an appropriate clear zone width that also allows a minimal footprint. The recommended typical sections allow for a minimum of 10’ of width for

clear zone accommodated by the shoulders for the fully widened sections, and between 2-10’ minimum elsewhere. This widening project only concerns the bridge and the approach work required to tie in the widening via tapers and other means. Due to the length of the project, the majority of the clear zone will be limited to the shoulder width as guardrail will be used as a barrier to protect the bridge ends from collisions as well as vehicles from going off the roadway near the bridge. Since the grade difference between the top of roadway and bottom of the stream are significant, guardrail is required for protection of both the bridge and side slopes and will therefore be the controlling object for clear zone. At locations where there is not any guardrail, the clear zone will vary depending on the constructed and or existing slopes and shoulder width.

Pedestrian and Bicycle Facility Consideration

Currently the facility does not have any bicycle or pedestrian only features such as: bike lanes, sidewalks, or shared use paths. There is not any significant bicycle or pedestrian traffic at this time to require the addition of bicycle and pedestrian facilities at this time.

UPDATED: 7/7/2016

WATER RELATED IMPACTS SUMMARY

County	Logan	**Route No.**	US 79	**Item No.**	03-10010.00
Date	04-23-2020	**Program #**	9484301D		
Federal Project No.	STP 079 1006				
State Project No.	FD52 071 0079 004-005				
Location Engineer	Wendy Southworth				

Section 1: Impact Checklist

The impacts for all alternates are similar with the variation being the type of bridge and number of piers.

FLOODPLAIN IMPACTS		
FEMA Study Type	**Yes**	**Community No.**
Detailed FEMA Study with delineated floodway*	☒	21141C0275D
Detailed FEMA Study without delineated floodway**	☐	
Approximate FEMA Study	☐	
No FEMA Study	☐	

***** If proposed design impacts the floodway, then it may require initiation of map revision process (CLOMR/LOMR).

** If proposed design impacts water surface elevations, then it may require initiation of map revision process (CLOMR/LOMR).

Potential impacts to floodplains and/or floodways shall be assessed early in the project. Refer to the Drainage Manual.

SIGNIFICANT RESOURCE IMPACTS	**YES**		**NO**	
Are open sinkholes impacted? If so, how many sinkholes are impacted?	☐		☒	
Are wetlands impacted? If so, how many total acres are estimated? _____ acres	☐		☒	
Are any of the streams in the project area designated “Special Use Waters” (e.g. Wild Rivers, Exceptional Waters, Outstanding State Resource Water, etc.)?	☐		☒	

Where possible, alignments should be developed that avoid significant resources. When it becomes impossible to avoid a significant resource, the project should be designed to minimize these impacts. Significant resource impacts are discussed in DR 202 of the drainage manual. Wetland impacts and their costs are discussed in DR 500 of the Drainage Manual.

Projects that impact special use waters may require an individual KPDES Erosion Control Permit. Contact the Division of Environmental analysis for more information.

STREAM CHANNEL IMPACTS	YES		NO	
Will stream relocations (channel changes) be needed? If so, check all that apply: 1. Will at least "1" relocation be over 100' in length? ☐ 2. Will at least "1" relocation be over 300' in length? ☐ 3. Will at least "1" relocation be over 500' in length? ☐ How many total linear feet are estimated? _____ LF	☐		☒	
Will new culverts or culvert extensions be constructed? If so, check all that apply: 1. Will at least "1" be over 300' in length? ☐ 2. Will at least "1" be over 500' in length? ☐ How many total linear feet are estimated? _____ LF	☐		☒	
Will temporary stream crossings be needed?	☐		☒	
Will excess material sites that require permitting be needed?	☐		☒	
Will bridges be constructed?	☒		☐	

On highway projects that involve stream crossings such as bridge and culverts, it is often not feasible to totally avoid stream channel impacts. In these cases, design the project to minimize the impacts. Stream relocations should be avoided if possible. If stream relocations are unavoidable design to project to minimize their impacts. Stream channel impacts are discussed in DR 506, 601-3, 608-2, and 802-3 of the drainage manual.

Section 2 : Impact Discussion

Complete this section for the chosen alternative. Discuss the selected alternate's influence on each of the impacts listed above. Discuss any avoidance, minimization and/or mitigation measures included in the project.

The selected alternate chosen was to avoid impacts on the headwater as the FEMA flood map shows a house in close proximity to the project is close to Zone A. The bridge was lengthened to 117' to increase the opening area to provide proper conveyance to minimize impacts to the headwater elevations. There are minimal ditching and approach work to avoid further impacts to the drainage area and flow paths.

Proper Erosion Control measures will be utilized per KYTC standards and will include BMP items such as silt fence, silt checks, etc. to protect the waters of Whippoorwill Creek.