Elbert County Bridge Asset Management Program

Final Asset Management Plan Report

October 2, 2019

Prepared for:

Elbert County

Prepared by:

Stantec Consulting Services Inc.

This document entitled Elbert County Bridge Asset Management Program was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Elbert County (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by _____
(signature)

Peter J. LaRue, PE

Reviewed by _____
(signature)

Brian Stigner, PE

Approved by _____
(signature)

Ryan Nataluk, PE

Table of Contents

EXECUTIVE SUMMARY ..... **I**

1.0 INTRODUCTION **1.1**

2.0 STRUCTURE INVENTORY DESCRIPTION **2.1**
2.1 SUMMARY OF INVENTORY 2.1
2.2 SAFETY 2.3
2.2.1 Traffic Barriers 2.3
2.2.2 Approach Roadway and Approach Railing 2.4
2.2.3 Signage 2.5

3.0 REPLACEMENT ASSESSMENT **3.6**
3.1 REPLACEMENT MATRIX 3.6
3.1.1 Approach 3.6
3.1.2 Replacement Scores 3.7
3.1.3 Replacement Matrix Results 3.8
3.2 VALUATION SCORING 3.11
3.2.1 Sufficiency Rating 3.11
3.2.2 Current Age, ADT, and Structural Deterioration 3.14
3.2.3 Valuation Scoring Results 3.16
3.2.4 Replacement Priority 3.16

4.0 COST ESTIMATION **4.16**
4.1 MAJOR STRUCTURE REPLACEMENT 4.17
4.2 USE OF LOW WATER CROSSINGS 4.18

5.0 REPAIR AND MAINTENANCE **5.19**
5.1 PRIORITIZATION MATRIX 5.20

6.0 CONCLUSION **6.21**

LIST OF TABLES

Table 2.1 Summary of Inventory 2.2
Table 3.1 Cost Component Scores 3.8
Table 3.2 Replacement Matrix Results - Summary 3.9
Table 4.1 Culvert Location Summary 4.17
Table 5.1 Baseline Prioritization Scoring 5.21

LIST OF FIGURES

Figure 2.1 Typical Curb on Double Tee Beam Bridges with Bare Decks 2.4
Figure 3.1 ELBT-182-0.7-01 ..... 3.10
Figure 3.2 Sufficiency Rating Composition 3.12
Figure 3.3 Failure of Repairs on ELBT-125-1.4-01 ..... 3.14
Figure 3.4 Halo Effect in Pier Wall: ELBT-166-1.3-01 ..... 3.15
Figure 5.1 Typical Map Cracking in Bare Concrete Deck 5.20

LIST OF APPENDICES

APPENDIX A REPLACEMENT ALTERNATIVES A.1

APPENDIX B VALUATION SCORING B.1

APPENDIX C COST ESTIMATION C.1

APPENDIX D PRIORITIZATION MATRIX D.1

APPENDIX E REPLACEMENT MATRIX NOTES E.1

LIST OF APPENDIX TABLES

Table A.1 Replacement Matrix A.1
Table B.1 Valuation Score and Replacement Priority B.1
Table C.1 Cost Estimate Summary - Bridge Replacement C.1
Table C.2 Cost Estimate Summary - Culvert Replacement C.1
Table C.3 Cost Estimate - Low Water Crossing C.1
Table C.4 Major Structure Replacement - Quantities Estimation C.1
Table C.5 Major Structure Replacement - Quantities Estimation (Part 2) C.1
Table C.6 Major Structure Replacement - Quantities Estimation (Part 3) C.1
Table C.7 Cost Estimate Calculations - Bridge Replacement C.1
Table C.8 Cost Estimate Calculations - Culvert Replacement C.1
Table D.1 Prioritization Matrix D.1

LIST OF APPENDIX FIGURES

Figure A.1 Replacement Recommendations Map A.1

Executive Summary

Bridge structures are valuable assets which are essential to maintaining a healthy transportation infrastructure system. The bridges in Elbert County act as critical links, completing roadway networks that connect communities and property owners spread out across 1,850 square miles. A proper bridge asset management program is necessary to preserve and extend the life of these important structures and to plan for the transportation needs of the future.

Elbert County owns and operates 34 major structures, comprised of 31 bridges and 3 culverts. Stantec was tasked with producing an asset management plan to assess the current needs of the existing structures and to formulate a strategy for maintaining and improving the overall level of service of the transportation system. This plan considers both the current and expected future usage of each structure to determine which bridges must remain bridges and which ones may be suitable for replacement with culverts or low water crossings.

After evaluating the county's inventory and assessing the importance of each structure, 6 bridge locations were identified as good candidates for replacement with low water crossings. Currently, 3 major structures are culverts, and it is recommended that another 7 bridges be replaced with culverts. A replacement schedule was created based on current life, sufficiency rating, ADT and structural condition which ranked the 34 structures in the order they are expected to be replaced. The remaining life of each structure was also estimated assuming that no corrective action was taken to extend their service life.

Cost estimates for major structure replacements were calculated based on available 2018 cost data. Replacement of the 34 structures with bridges or culverts would cost a total of $22 million. If no changes are made to the current level of maintenance, 19 structures may need to be replaced in the next 20 years at a total cost of $9.5 million: roughly $475,000 per year. If all 6 recommended locations were converted into low water crossings, about $4 million in total replacement costs could be saved. Investing in targeted repair and maintenance items in the next five years will also extend the life of the bridges; per year expenditures would increase over the next 5 years to address these maintenance needs, but overall costs would be reduced over 20 years as the existing bridges will be kept in service longer.

1.0 INTRODUCTION

Elbert County has 34 major structures in their inventory for which they are responsible to maintain and manage. Currently, no comprehensive plan exists which places the short-term needs of the structures in context of the long-term sustainability of the inventory. The condition of Elbert County's structures is mostly fair and good with none reported as structurally deficient. But 20 bridges are over the age of 50, and significant bridge replacement efforts could be necessary in the next 15 to 20 years. The objective of this project is to provide the County with an asset management program that will help them prioritize funding and personnel allocation to maximize the longevity of their current infrastructure while planning for the needs of the future.

The first step in creating the bridge asset management program was to assess the existing inventory. CDOT routine inspection reports from 2015 and 2017 were reviewed along with photos, as-built sketches, and historical stream profiles. Site visits by Stantec engineers were performed at each structure location on 8/14/18 and 8/17/18 to gain familiarity with the site, conduct safety evaluations, and consider the feasibility of various structure replacement options. Additional photos were taken during the site visits. Direct input from the County was also gathered through progress meetings. Together, this information was used to determine the existing condition of the 34 structures and to provide a basis for future recommendations.

The next step involved determining what needed to be done with the major structures once they reached the end of their service life. In the case of some of the newer bridges, the end of their service life might not come for another 50 years or longer. But the future requirements were still considered so that a complete view of the financial burden of replacing these structures could be determined. The 3 alternatives considered were replacement with another major structure, replacement with a low water crossing, and closure of the crossing. Cost estimates were also created for each recommended replacement alternative to aid in budgeting. The existing condition of the bridges and their importance to the County were then considered to determine a replacement priority list.

An estimated remaining life was determined for each structure. This estimate assumed that no actions were taken and the structures were allowed to deteriorate at their current rate. A far more favorable outcome could be produced if preventative measures were enacted. The recommended actions in the asset management program are focused on short and medium-term actions that will increase the long-term health of the structures. Most improvement items have targeted completion dates within 15 years, including both repair items and ongoing maintenance. If these recommendations are incorporated into the County's plan, the service life of the existing inventory will be lengthened and the overall cost of maintaining the infrastructure will be reduced.

2.0 STRUCTURE INVENTORY DESCRIPTION

2.1 SUMMARY OF INVENTORY

Elbert County owns and operates 34 major structures, including 31 bridges and 3 culverts. Many of these structures are located in the more developed and densely populated western part of the county; 14 are located west of Kiowa. As discussed in the 2008 West Elbert County Transportation Master Plan, the development pressures are highest in this western region.

The roads in this region have the highest traffic counts in the county, including all of the measurable truck traffic. 8 bridges carry commercial truck traffic, with truck percentages ranging from 1% to 9% of the average daily traffic. Traffic counts have only identified passenger vehicle traffic on the remaining bridges, although it is assumed that many of these bridges also carry farm vehicles.

The average age and quality of the bridges in western Elbert County is younger and better than elsewhere in the county. Only 14 structures in the county are under the age of 50, and 12 of them are located west of Kiowa. 7 bridges, located on CR 25, CR 194, and CR 166 (Singing Hills Road) are on asphalt paved roads. The remainder are on unpaved dirt roads.

The more recently built structures have a wide variety of superstructure types, including concrete slab on concrete girders, concrete double tees or steel girders, concrete box beams, and corrugated metal pipes culverts. With one exception, the 20 bridges aged 50 years and older are concrete double tee beam bridges. These bridges are supported by steel pile abutments and piers with precast concrete caps. None of the 19 double tee beam bridges have a topping slab or deck, and many do not have curbs or a properly functioning railing system.

A complete list of Elbert County's structure inventory is presented in Table 2.1.

Table 2.1 Summary of Inventory

Structure	Age	Bridge Length (ft)	Description
ELBT-13-0.5-01A	30	104	1-span Concrete slab on concrete girders
ELBT-17-2.2-02A	30	171.7	3-span Concrete double tees
ELBT-25-4.60-6A	20	26.6	3-span Corrugated metal pipe culverts
ELBT-25-7.61-03	39	22.7	3-span Corrugated metal pipe culverts
ELBT-25-12.2-01	31	168.5	2-span Concrete slab on steel girders
ELBT-65-4.30-01A	31	105	1-span Concrete slab on concrete girders
ELBT-69-3.50-01	53	160	4-span Concrete double tees
ELBT-74-1.90-01	29	150.8	3-span Concrete double tees
ELBT-98-0.20-2A	16	25.3	6-span Corrugated metal pipe culverts
ELBT-98-0.30-02	53	180	5-span Concrete double tees
ELBT-98-0.50-03	53	100	3-span Concrete double tees
ELBT-98-1.30-01	28	85.3	1-span Concrete slab on steel girders
ELBT-99-0.80-01	53	180	5-span Concrete double tees
ELBT-105-4.9-02	53	219.8	6-span Concrete double tees
ELBT-125-1.4-01	54	200	5-span Concrete double tees
ELBT-125-7.8-02	54	180	5-span Concrete double tees
ELBT-150-3.6-02	28	293.9	7-span Concrete slab on steel girders
ELBT-158-0.1-01	53	180	5-span Concrete double tees
ELBT-162-0.5-01	53	60	2-span Concrete double tees
ELBT-162-3.9-01	52	201	5-span Concrete double tees
ELBT-162-5.3-02	53	140	4-span Concrete double tees
ELBT-166-0.5-06	54	160	4-span Concrete double tees
ELBT-166-1.3-01	40	119.8	2-span Concrete double tees
ELBT-166-4.3-05	53	160	4-span Concrete double tees
ELBT-170-0.9-01	99	71	3-span Continuous steel rolled beam
ELBT-174-4.4-1A	26	222.2	3-span Concrete slab on steel girders
ELBT-178-3.6-01	54	80	2-span Concrete double tees
ELBT-178-3.7-02	54	70	2-span Concrete double tees
ELBT-182-0.7-01	53	40.3	1-span Concrete double tees
ELBT-182-4.1-02	53	40	1-span Concrete double tees
ELBT-190-0.3-01	54	240	6-span Concrete double tees
ELBT-194-6.5	37	32.2	1-span Concrete double tees
ELBT-194-6.6	37	62.7	1-span Concrete box
ELBT-194-11.6	54	150	5-span Concrete double tees

2.2 SAFETY

The safety conditions at each bridge site vary throughout the county. Generally, the bridges in the western part of the county meet a higher safety standard than those in the more rural areas. Traffic barriers, approach roadway and railing, and signage were all considered as part of the safety evaluation.

2.2.1 Traffic Barriers

All bridges under the age of 50 have a barrier/railing that is appropriate for the type of traffic crossing the bridge. The design plans for these bridges were not available, but it is assumed that the railing connections follow the design specifications which governed at the time of their construction. At the culvert locations, only one crossing (ELBT-25-4.60-6A) is protected by guardrail.

Only one of the bridges older than 50 years (ELBT-194-11.6) has a functioning traffic barrier. The other 1960's era double tee beam bridges were built with cable railing supported on steel tube posts. The posts have been knocked over on several of the bridges, and the cable is hanging beside the bridge. On the bridges that have kept their cable railing intact, this serves more as an indicator of the edge of deck location than as a functioning barrier. The cable railing would not be able to withstand an impact load from the smallest traveling vehicle.

A concrete curb has been installed on each double tee beam bridge except for ELBT-182-0.7-01. The curbs are 7½" tall, which is high enough to deflect vehicular traffic travelling at low speeds. However, soil has accumulated on many of the bridge decks due to grading operations on the approach roads. If the soil is more than 1½" deep on the bridge, resulting in an exposed curb height of less than 6" and should be assumed mountable. Accumulation of additional soil in the corner between the deck and the curb – as shown in Figure 2.1 – will also reduce the effectiveness of the curb to deflect traffic, even if the average soil thickness across the deck is less than 1½". Excessive soil on the deck also traps moisture against the concrete and could cause faster corrosion of the double tee beams. Elbert County maintenance crews should endeavor to keep the bridge decks as free of soil as possible and to prevent soil buildup against the curbs.

The 1960's era double tee beams have 5½" thick top flanges with single rows of longitudinal and transverse reinforcing. Given this detailing, it is unlikely that a railing connection could be made that would meet modern standards. Adding a substandard railing would provide a false sense of security to drivers and may cause damage to the beams if struck by a vehicle. Instead, delineators should be installed on all of the older double tee beam bridges along both edges of deck. This will serve as a warning indicator for the edge of deck location.

Figure 2.1 Typical Curb on Double Tee Beam Bridges with Bare Decks

2.2.2 Approach Roadway and Approach Railing

Approach roadways are governed by two primary design standards, the AASHTO - A Geometric Design of Highways and Streets, 2007 – 6th Edition and the AASHTO - Roadside Design Guide, 2011 – 4th Edition. These design guides lay out the basic parameters for all aspects of roads and highways in the United States, including bridge approaches and roadside safety. Both of these documents outline many recommendations to improve driver safety, but each site is unique and engineering judgment should always be factored into any proposed improvement.

In general, most of bridges reviewed as part of this study are on very rural 2-lane roadways. In many cases the roadways are unpaved, and the bridges are only wide enough for one lane of traffic. Typically, good practice would be to have an approach barrier system tied into the bridge rails, but as mentioned in the previous section, many of the bridges we reviewed did not have anything more than a simple, non-crashworthy cable. It was also noted that all of the one lane bridges are accessed on both sides by 2-lane or wider roadways with limited or no advance notification.

At several of the bridges that did have approach guardrail, it was found in need of repair, replacement or the nose terminals modified so as not to create an obstruction. Improperly installed or damaged guardrail can be more dangerous than not having it at all.

Maintaining a clear line of site approaching each of the bridges is also highly recommended. We noticed several bridges were at the receiving end of blind horizontal or vertical curves and/or were obstructed by

overgrowth and trees. A couple of the bridges that did have approach guardrail and delineators were buried in vegetation.

An important and effective form of roadside and approach safety is the use of delineators. Delineator usage and placement in Colorado is defined in the 2012 CDOT M&S Standards book. Adding delineators to rural roadways, especially adjacent to obstructions and on bridges and bridge approaches is one of the most effective and least expensive forms of safety available. The lenses in modern delineators can reflect a vehicles headlight from more than a mile away, giving drivers plenty of warning. Several of the sites we reviewed as part of this study had some delineators on or adjacent to the bridges, but they were very limited. None of the sites had delineators placed in accordance with the M&S Standards. At less than $20 each, adding some level of delineators to every one of the sites would likely be the quickest, easiest and most cost-effective safety improvement available.

If a bridge is being improved, replaced, or just undergoing safety upgrades, we would recommend some type of barrier system on both approach and departure lanes tying into the bridge rail. Incorporating delineators and proper signage is also highly recommended.

2.2.3 Signage

Although there are some local and State guidelines, most signage in the United States is defined in the Manual of Uniform Traffic Control Devices (MUTCD) – 2009 Edition. Effective signage is often a balancing act between too few and too many signs. Signage is the most effective way to communicate to a driver about what to expect. Each bridge in this study had some level of signage associated with it, often just a couple simple object markers at both ends of the bridge. Many of the existing signs that are in place have outlived their life span and no longer have the reflectivity as required by the MUTCD, are bent or have bullet holes. No reflectivity testing was performed.

Following CDOT's Class I sign installation details, adding rural signage, like delineators is an inexpensive and practical way to greatly increase safety. Depending on the specific bridge site, we would recommend looking into the following for each location:

- OM3 – Object markers on each corner of the bridge
- W5-2 – Narrow Bridge
- W5-3 – One-Lane Bridge
- W7-1 – Steep Hill Ahead
- W1-8 – Chevron
- W11-4 - Cow
- W16-9P – Ahead (in conjunction with other warning signs)

Listed are just several of the recommended signs that could be used to better inform drivers of upcoming conditions, especially at night or during poor weather.

3.0 REPLACEMENT ASSESSMENT

The average age of the major structures owned by Elbert County is 45 years. Bridges built in the early to mid-1900's typically had a design life of 50 years, and over half of the bridges in Elbert County have surpassed this age. Proper maintenance and timely repairs can sustain the existing inventory well beyond its expected life, but considerations need to be made about the future of these structures. 19 bridges are between 52 and 54 years old, and these bridges may reach the end of their useful life within a short time period. The impact this has on the county will depend on the strategy employed by the county to replace these structures.

Replacing each existing bridge with a similar structure designed according to modern standards would provide the highest level of service, but this approach would not be cost effective. Many of the oldest bridges in the county are on lightly travelled roads that are not likely to see development in the near future. Alternative replacement structures should be considered which would still provide an adequate level of service based on the current and future needs of the road while minimizing the financial burden to the county. A strategy for identifying appropriate locations for such alternative structures is outlined below.

It is not the intention of this assessment to imply that these replacement strategies be enacted in the near future. The analysis of replacement alternatives only identifies which replacement structure is most suitable at each structure location once the existing structure has reached the end of its service life.

3.1 REPLACEMENT MATRIX

3.1.1 Approach

Three structure replacement alternatives were considered for each bridge location. The first alternative was replacement with a new major structure. Depending on hydraulic demands, the recommended structure would be either a bridge or a culvert. Preliminary hydraulic analysis indicates that as many as ten major structures in Elbert County could be culverts, compared to only three culverts presently. The second alternative was a low water crossing. In this case the existing structure will be completely removed and the road will be lowered into the channel. During storm events, the creek will overtop the road and the crossing will be impassable during storms. The final alternative was closure of the crossing.

Scores were created for each alternative in the categories of Feasibility, Cost, and Impact. The Feasibility score considers availability of materials and constructability, site constraints, environmental impact, hydraulics, and how adequately the alternative met the requirements of the functional level of the road. The Cost score considers the cost of constructing the replacement as well as the potential impact to commerce. The Impact score considers the usage of the bridge in terms of Average Daily Traffic (ADT), percentage of truck traffic, the detour for temporary or permanent closures, and the importance of the bridge to the future development of the county. The Impact score is multiplied by an additional Impact Factor. This factor is based on the increased importance of maintaining a dependable route through areas of higher development pressures and along collectors and arterials.

High scores correspond to a more favorable alternative; i.e., a high feasibility score indicates a highly feasible alternative, a high cost score indicates a lower cost alternative, and a high impact score indicates an alternative with a low impact to the community. The three scores were added together and compared to the aggregate scores of the other two alternatives for each bridge. The alternative with the highest score was considered the best alternative for that bridge. In the case of a tie, the lower cost option was recommended. Comparisons should only be made between the three alternatives for each bridge, and relative scores between different bridges will not necessarily provide meaningful comparisons.

Detailed notes justifying the component scores used in the replacement matrix can be found in Appendix E.

3.1.2 Replacement Scores

3.1.2.1 Feasibility

The feasibility scores had low variability between different bridges for both the major structure replacement and bridge closure options. Replacement with a major structure is a highly feasible option, and all of the structures except for two had feasibility scores of either 9 or 10 for replacement. Maintenance of traffic on major roads and scour concerns were the primary factors which would reduce the feasibility score from 10 for the replacement alternative. For the bridge closure alternative, feasibility scores were only affected by a single criterion: “meets requirements for functional level of road”. Most locations were given a 0/2 for this factor, but locations with very low ADT on local rural roads with short to moderate length detours were given 1/2.

The low water crossing alternative presented much more variability in the feasibility score. The approach road conditions and the slope of the channel banks had a large impact on the “site constraints” component of the feasibility score. The “environmental impact” component depended on whether the stream was seasonal or continuous, and whether wetlands were assumed present in the vicinity of the bridge. No wetland studies were completed. The “hydraulics” component was directly related to the channel flow during regularly occurring storms. The low water crossings should ideally have small diameter culverts that can convey typical flows during small storms. This way the stream will only overtop the roadway infrequently. If the channel carries high flows on a regular basis, then the entire crossing will be more difficult to construct and maintain. Lastly, the “meets requirements for functional level of road” component varied between 0/2 and 2/2 depending on the classification of the road.

3.1.2.2 Cost

The base cost scores were assigned according to Table 3.1. An additional point was removed from the score for the low water crossing and bridge closure alternatives if the structure carries truck traffic and the replacement alternative would negatively impact commerce.

Table 3.1 Cost Component Scores

Score	Action/Cost
10	Close Crossing
9	Replacement Cost < $100,000
8	Replacement Cost < $200,000
7	Replacement Cost < $300,000
6	Replacement Cost < $500,000
5	Replacement Cost < $700,000
4	Replacement Cost < $900,000
3	Replacement Cost < $1,100,000
2	Replacement Cost < $1,300,000
1	Replacement Cost > $1,300,000

3.1.2.3 Impact

The impact score was largely a product of the traffic crossing the bridge. Because replacement with a major structure will not diminish the level of service provided by the road, the Impact score for the major structure replacement alternative is 10 for all locations. The low water crossing alternative had scores ranging from 2 to 9, and the closure alternative had scores ranging from 1 to 7. Very low ADT routes with no truck traffic and short detour lengths were given the highest scores. Bridges carrying higher volumes of traffic and the addition of trucks lowered the score. Excessively long detours lowered the score significantly.

The Impact score was multiplied by the Impact Factor before calculating the Total Score. The Impact Factor is the product of two components: the development pressures in the region of the county where the structure is located and the functional class of the road. The development pressures are taken from the 2008 West Elbert County Transportation Master Plan, Figure 5-1. The component factor is taken as 1.3 in areas of high development pressure and 1.15 in areas of moderate development pressure. The following component factors are used for the functional class: Minor Arterial = 1.4; Major Collector = 1.2; Minor Collector = 1.05; Rural Local = 1.0. So, for example, a structure located on a major collector in an area of high development would have an Impact Factor = 1.2 x 1.3 = 1.56.

3.1.3 Replacement Matrix Results

All thirty-four major bridge and culvert structures were included in the replacement matrix. A summary of the recommended replacement alternatives is shown below in Table 3.1. A complete summary of the individual component scores can be found in Appendix A.

Table 3.2 Replacement Matrix Results - Summary

Major Structure Replacement Recommended		Low Water Crossing Recommended	Bridge Closure Recommended
ELBT-13-0.5-01A	ELBT-162-0.5-01	ELBT-98-0.50-03	ELBT-98-0.30-02
ELBT-17-2.2-02A	ELBT-162-3.9-01	ELBT-99-0.80-01	
ELBT-25-4.60-6A	ELBT-162-5.3-02	ELBT-105-4.9-02	
ELBT-25-7.61-03	ELBT-166-1.3-01	ELBT-166-0.5-06	
ELBT-25-12.2-01	ELBT-170-0.9-01	ELBT-166-4.3-05	
ELBT-65-4.30-01A	ELBT-174-4.4-1A	ELBT-190-0.3-01	
ELBT-69-3.50-01	ELBT-178-3.6-01		
ELBT-74-1.90-01	ELBT-178-3.7-02		
ELBT-98-0.20-2A	ELBT-182-0.7-01		
ELBT-98-1.30-01	ELBT-182-4.1-02		
ELBT-125-1.4-01	ELBT-194-6.5		
ELBT-125-7.8-02	ELBT-194-6.6		
ELBT-150-3.6-02	ELBT-194-11.6		
ELBT-158-0.1-01			

Potential low water crossing candidate in bold

The twenty-seven structures shown in the left two columns of Table 3.2 scored highest for a major structure replacement, either with a bridge or with culverts. The structure listed in the far right column scored highest for a bridge closure, and the county agreed that a closure made sense based on the low ADT and the short detour length. Five of the remaining six structures had low water crossing scores that were higher than or tied with the major structure replacement option. ELBT-98-0.50-03 scored highest for bridge closure, but based on comments from Elbert County it is recommended that this bridge be replaced with a low water crossing to avoid an overly long detour.

The main component that put the low water crossing alternative on top was Cost, with a difference of 3-5 points between the low water crossing and the major structure alternative for all six locations. These locations also had a moderate to high feasibility for low water crossings, and the impact factor was low. Low water crossings received the highest scores only where development pressures were low and at crossings that were on rural local roads.

Every existing structure west of CR-69 scored highest for a major structure replacement because of high development pressures, higher ADTs, and the functional class of the road. Eleven structures east of CR-69 also scored highest for a major structure replacement, largely due to difficulties of constructing a low water crossing or hydraulics requirements. Detailed notes justifying each component score can be found in Appendix E, but a summarization of the key factors for these recommended major structure replacements is given below:

- ELBT-125-1.4-01 and ELBT-125-7.8-02 are located on minor collectors and have detour lengths of 14 miles. Low water crossings will be periodically closed during and possibly after storm events and may not be suitable for structures on important routes with long detours.

- ELBT-162-0.5-01, ELBT-170-0.9-01, and ELBT-178-3.6-01 all have year-round water and apparent wetlands under the bridge and would have a high environmental impact if they were replaced with a low water crossing. These 3 bridges are also short, reducing the cost of a major structure replacement.
- ELBT-170-0.9-01 and ELBT-178-3.6-01 could also be replaced with culverts, which reduces the cost of the major structure replacement significantly and increased the score for the major structure alternative.
- ELBT-178-3.7-02 is short with steep banks and has a large drainage basin. A low water crossing here would be difficult to construct.
- ELBT-182-0.7-01 is located on a rural local road, but it has a very deep channel with steep banks as well as a 15-mile detour and would not be well suited for a low water crossing (see Figure 3.1).

Figure 3.1 ELBT-182-0.7-01

Short bridges with steep banks are poor candidates for low water crossings

- ELBT-182-4.1-02 is located on a rural local road, but the detour length is 15 miles. The structure length is also only 40 feet, making this one of the less expensive major structure replacements.

Three locations that are recommended for major structure replacements were identified as possible candidates for low water crossings: ELBT-69-3.50-01, ELBT-150-3.6-02, and ELBT-158-0.1-01. These bridges all have low water crossing alternative scores that are within 15% of the major structure replacement score and are not in areas of high or moderate development pressures. A low water crossing alternative should be investigated as part of a type selection study when these bridges are ready to be replaced.

A map showing all of the bridge locations, along with the recommended replacement alternatives for each location, can be found in Appendix A.

3.2 VALUATION SCORING

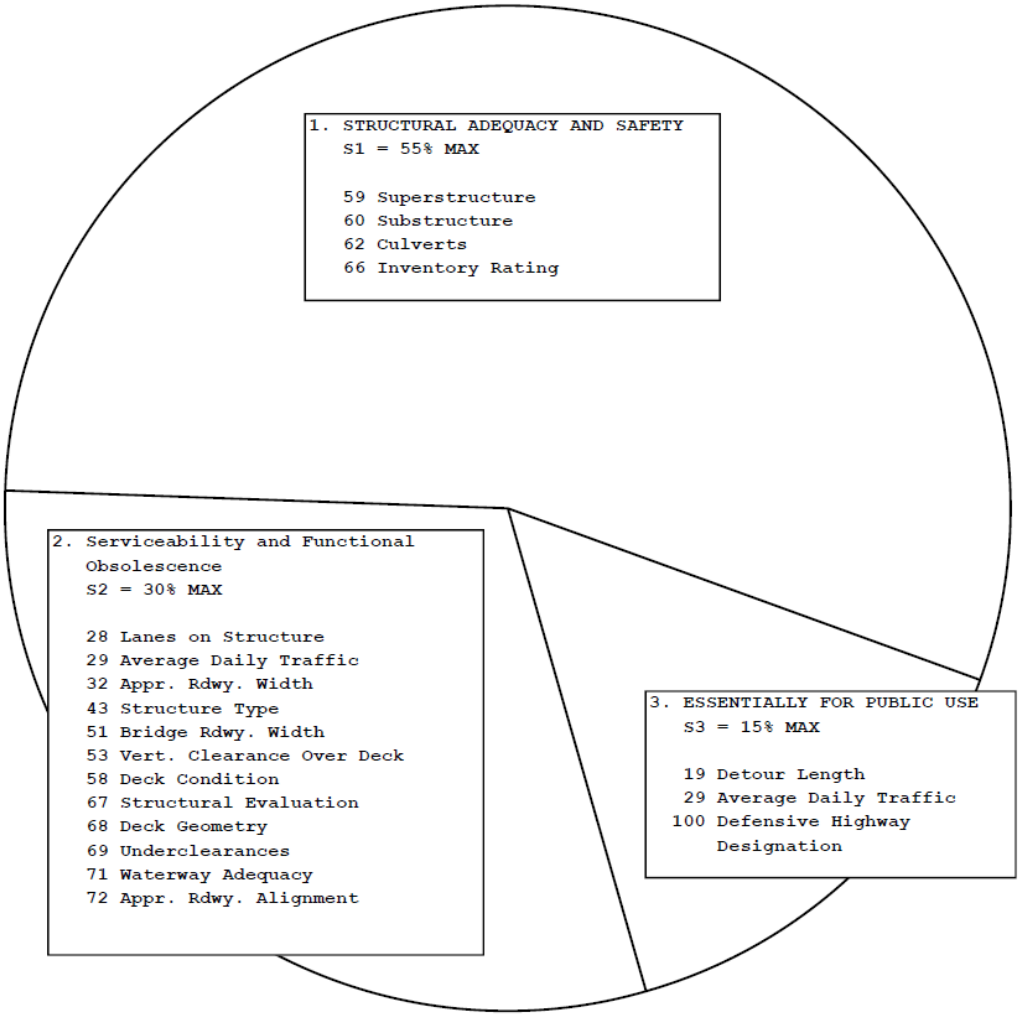
The replacement matrix provided a comparison of replacement alternatives. Additional metrics that outline the priority and relative sequence of replacements are necessary to fully plan for the future of the Elbert County structures. A valuation scoring system was created to help rank each existing structure in the order it is expected they will need to be replaced.

The valuation score is comprised of 4 parts: the Sufficiency Rating, contributing 0-20 points; the Current Age, contributing 0-10 points; the Average Daily Traffic (ADT), contributing 0-5 points; and the Structural Deterioration, contributing 0-5 points.

3.2.1 Sufficiency Rating

The Sufficiency Rating is included as a part of the Structure Inventory and Appraisal Report for every bridge. It is a score out of 100 that is intended to determine how adequate a bridge is for a given crossing. The score is taken as the sum of 3 parts, with an allowance for special reductions. The composition and proportions of these parts is outlined in Figure 3.2 below.

Figure 3.2 Sufficiency Rating Composition



FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges Appendix B, Figure 1

The sufficiency rating captures the current condition, importance and functionality of the bridge, but it is an incomplete measure of the bridge's performance. The parts of the sufficiency rating will be described in further detail, and the need for additional criteria for the valuation score will be outlined in the following sections.

3.2.1.1 Structural Adequacy and Safety

Part 1 is worth 55% of the sufficiency rating, and it is calculated from two components. The first is the Superstructure and Substructure Condition Ratings in the case of a bridge, or the Culvert Condition Rating for culverts. These ratings are subjective assessments of the structure's condition which are determined following FHWA guidelines during the bridge's biennial inspection. The second component is the inventory load rating of the structure.

These two components do not constitute constant fractions of the Part 1 score. For example, if the worst condition rating is very poor (2 or less out of 9), but the load rating is good, then the overall Part 1 score would still be 0%. Conversely, if the condition ratings are good but the inventory load rating is very low, the Part 1 score could also be 0%.

Information that is not captured in the Part 1 assessment is how widespread deterioration is. The condition rating component of the Part 1 score only considers the worst condition rating. A structure with a "Fair" superstructure condition and a "Very Good" substructure condition will receive the same score as one where both the superstructure and substructure have a "Fair" condition. The condition ratings also do not account for the frequency of the deterioration. A bridge that has minor section loss on half the girders might receive the same condition rating as a bridge that has minor section loss on every girder.

3.2.1.2 Serviceability and Functional Obsolescence

Part 2 is worth 30% of the sufficiency rating, and it is derived from many components which are listed in Figure 3.2. The approach used to calculate the value of Part 2 organizes the components into 3 categories: Rating Reductions, Width of Roadway Insufficiency, and Vertical Clearance Insufficiency.

The Rating Reductions are worth 13% and include factors similar to the Condition Ratings of Part 1. These factors cover 6 items both on and adjacent to the bridge. The Vertical Clearance Insufficiency is worth 2%, and it only applies to bridges that cross roads. None of the bridges maintained by Elbert County cross roads. The Width of Roadway Insufficiency is worth 15%. It considers the curb-to-curb width of the bridge and its adequacy for carrying the number of lanes and ADT of that road. For structures with low ADT, the impact to the Sufficiency Rating due to a substandard roadway width is diminished.

3.2.1.3 Essentiality for Public Use

Part 3 is worth 15% of the sufficiency rating. It covers the detour length and the Defensive Highway Designation (if applicable). The impact of the detour length is entirely dependent on the ADT. For the bridges in Elbert County with very low ADT's, the impact of the detour length becomes negligible. For example, a bridge with an ADT of 50 vehicles per day and a detour length of 16 miles still gets 14.94% for Part 3.

3.2.2 Current Age, ADT, and Structural Deterioration

Three additional factors were added to the Valuation Scoring metric to supplement the Sufficiency Rating. Combined, the Current Age, ADT, and Structural Deterioration factors have a weight equal to the Sufficiency Rating. The purpose of adding these factors is to create a more comprehensive approach to assessing the current and expected future condition of the structures in Elbert County.

The components of the Sufficiency Rating do not consider progression of deterioration or factors that will cause faster deterioration in the future. Successive failures of repairs due to the halo effect, for example, are not considered. Efflorescence and other indicators of water penetration through the deck do not affect the Condition Ratings used in Part 1. Signs of water saturation in the concrete and potential active rusting of the steel reinforcing, such as failure of repairs and repeated spalling in the same locations, are also not incorporated into the Sufficiency Rating.

Figure 3.3 Failure of Repairs on ELBT-125-1.4-01

The impact that existing structural deterioration has to the remaining life of the structure was assessed for each structure. Previous inspection reports and the August 2018 site visits were used to identify locations of deterioration, and the frequency and severity of the individual problems were considered to assign a score from 0-5.

Figure 3.4 Halo Effect in Pier Wall: ELBT-166-1.3-01

New deterioration is visible around the repair of the pier wall

Structural deterioration is an indication of existing problems; Current Age and ADT are useful to predict the expected rate of future deterioration. As discussed in Section 3.2.1, ADT is used by the Sufficiency Rating, but only to determine the bridge's impact on traffic. ADT is included in the Valuation Score so that the frequency of loading cycles can be accounted for. Structures that only carry 50 vehicles per day can be expected to last much longer than those that carry 2000 vehicles a day. Current age will also have a large impact on expected remaining life, regardless of the amount of visible deterioration. None of the 1960's era double tee beam bridges in Elbert County have decks; therefore road salts and water gathering on the tops of the bridges will travel directly into the girder concrete or down the sides of the girders through the open longitudinal joints. Even if spalling and cracking is minimal now, 50 years of water penetration has likely negatively impacted these girders. Their expected remaining life will be affected by how long they've been exposed to these conditions.

The ADT score is equal to the ADT count divided by 800. The score for Current Age is not directly linear. Older bridges typically had a design life of 50 years, while more modern bridges have a design life of 75 years. However, many bridges exceed their design life, particularly when traffic counts and truck usage are low. Therefore, bridges built before 1980 will be scored relative to an effective life of 80 years, while bridges built after 1980 will be scored relative to an effective life of 100 years. Bridges older than 80 years will have a score of 0. Thus:

$$\text{Age score (pre-1980)} = [80 - \text{AGE}]/8$$

$$\text{Age score (post-1980)} = [100 - \text{AGE}]/10$$

3.2.3 Valuation Scoring Results

The individual parts of the Valuation Score were added together to get a total score with a maximum possible value of 40. The scores were then divided by 40 to get a ratio between 0 and 1, with lower scores being worse. The scores highlight both current level of adequacy and the expected future performance of the bridge. High scores (anything above 0.800) indicate that the bridge is in good health and that replacement will not be required in the near future, although preventative maintenance will still be beneficial to maintain the current good health of the bridge. Twelve structures have a score of 0.800 or higher, and all but one of these structures is located in the western part of the county. Eight structures had scores that were less than 0.800 but greater than or equal to 0.700. Scores in this range indicate that these structures will require some repairs and preventative maintenance to extend their lives, but replacement should not be a major concern if these needs are met. The remaining fourteen structures had scores ranging from 0.400 to 0.675. These bridges are closest to needing replacement. Repairs and maintenance will extend their service life, but Elbert County should start creating a plan for their replacement.

A complete list of the Valuation Scores, as well as the component scores, can be found in Appendix B.

3.2.4 Replacement Priority

The replacement priority is based on the Valuation Score, the estimated remaining life, and the relative importance of the structure. The last criterion is included because a bridge located on a rural local road and carrying only 20 vehicles a day might be left in service close to the end of its useful life, whereas a bridge on a major collector would schedule a replacement with no risk of disruption to the operation of the road.

The estimated remaining life is based on the assumption that no repairs and no preventative maintenance is performed, and that all structures are allowed to continue deteriorating at their current pace. If the suggested repairs are completed, many of the bridges in remote locations which carry low traffic counts and no trucks could remain in service a very long time.

The estimated remaining life and replacement priority can be found in Appendix B.

4.0 COST ESTIMATION

Elbert County has nineteen bridges between 52 and 54 years old. None of these bridges are in need of immediate replacement, but replacement will become a concern in the next 15 to 20 years. Likely, many of these bridges will reach the end of their service life around the same time as they were all constructed around the same period and experience similar issues. It is important that Elbert County begin to plan for the future of these structures and understanding the relative cost of their replacement is an important part of that.

The estimated construction cost of replacing each structure with a new major structure was calculated using 2018 cost data. The cost estimates are for information only; design calculations have not been performed for these structures. Costs were tabulated individually for substructure, girders, deck, and railing based on preliminary quantities and CDOT cost data. Additional costs associated with the construction of the structure such as borrow, excavation, structural fill, topsoil, erosion control, roadway material, riprap, bearing devices, and mobilization were included as a multiplier of the individual structure costs. The multiplier varied depending on the structure type and length. Many of the costs associated with a structure replacement – adjacent roadway work, mobilization, borrow, excavation, structural fill – are not proportional to the length of the structure, and therefore the multiplier will be larger for shorter structures.

Summaries for the cost estimates of each crossing and their associated quantities calculations are located in Appendix C. The estimates do not include the cost of an environmental study or a design fee.

4.1 MAJOR STRUCTURE REPLACEMENT

A cost estimate was created for each structure assuming that it was replaced with a new major structure (with the exception of ELBT-98-0.30-02, which is recommended for closure at the end of its service life). The replacement assessment considered replacing bridges with culverts where possible. StreamStats reports were used to generate peak flow predictions for the 100 Year Peak Flood. Culverts were included as a replacement alternative when the flow was small enough to be carried entirely by culverts. In some cases, the required culvert sizes would be very large and the replacement bridge could be short and inexpensive. Cost estimates were created for both bridge and culvert replacements in these cases and the less expensive alternative was recommended.

In all, 10 structures were suited for replacement with culverts. These include 3 structures which are currently corrugated metal pipe (CMP) culverts: ELBT-25-4.60-6A, ELBT-25-7.61-03, and ELBT-98-0.20-2A. 6 more bridges are recommended to be replaced with CMP or HDPE culverts, and 1 bridge is recommended to be replaced with a concrete box culvert. A summary of the suggested culvert locations is shown in Figure 4.1 below.

Table 4.1 Culvert Location Summary

Structure	Culvert Type
ELBT-25-4.60-6A	CMP or HDPE
ELBT-25-7.61-03	CMP or HDPE
ELBT-65-4.30-01A	CMP or HDPE
ELBT-69-3.50-01	CMP or HDPE
ELBT-74-1.90-01	CMP or HDPE
ELBT-98-0.20-2A	CMP or HDPE
ELBT-98-1.30-01	CMP or HDPE
ELBT-170-0.9-01	Concrete Box
ELBT-178-3.6-01	CMP or HDPE
ELBT-182-0.7-01	CMP or HDPE

In 2018 dollars, replacing every structure in Elbert County with another major structure would cost approximately $22 million. The 23 bridge replacements come to a total of $19.6 million, and the 10 culvert replacements would cost about $2.3 million.

4.2 USE OF LOW WATER CROSSINGS

Low water crossings are a good alternative to major structures on roads with low traffic demands and where the route isn't critical. Low water crossings lower the road into the existing channel and can utilize local improvements to the channel or can traverse directly across the streambed. The latter option is only viable when the soils in the channel are sandy and fast-draining. For the crossings in Elbert County, the roadway would likely need to be improved or reinforced, at least near the base of the channel.

Depending on the typical flow of the stream, the low water crossing could be at the same elevation as the streambed or raised several feet with small diameter culverts to allow small flows to pass underneath the roadway. Of the 6 low water crossing locations, only ELBT-99-0.80-01 had flowing water during the 08/2018 site visit. The site visit occurred during a very dry time of the year, and photos show ELBT-98-0.50-03, ELBT-99-0.80-01, ELBT-105-4.9-02, and ELBT-166-0.5-06 with flowing water during one or both the 2015 and 2017 inspections. If flowing water is present 2 or 3 seasons of the year, it may be advisable to construct the low water crossing with culverts so that the roadway isn't overtopped on a regular basis. ELBT-166-4.3-05 and ELBT-190-0.3-01 did not have any flowing water during the 2018 site visit or the 2015 and 2017 inspections, despite a rain event occurring during the 2015 inspection. These locations may only carry water during storm events, and it could be effective to construct a low water crossing at these locations without a raised roadway.

In the cost estimation, ELBT-98-0.50-03, ELBT-99-0.80-01, ELBT-105-4.9-02, and ELBT-166-0.5-06 were assumed to use 3 ft or 4 ft diameter culverts to convey normal stream flow. The roadway would need to be elevated another foot above the culverts, creating an obstruction in the channel. It was assumed that grouted riprap would need to be installed to protect the roadway. ELBT-166-4.3-05 and ELBT-190-0.3-01 were assumed to have infrequent enough flows that culverts could be avoided, and therefore the roadway does not need to be reinforced. An aggregate base course (ABC) was included in the cost of all low water crossings. Additionally, the cost of removing the existing bridge was factored into the low water crossing cost.

The total estimated cost of the 6 recommended low water crossings is $900,000. The cost of building major structures at these locations is estimated to be $5 million. Replacing the existing structures with low water crossings could save Elbert County over $4 million on construction costs at an average savings of $680,000 per crossing.

Long-term maintenance costs were not included in this study. Low water crossings do require additional maintenance after storms and washouts to clean the debris from the culverts and re-grade the road. However, this work could be performed by the County and will be a relatively small burden compared to the cost of building a new bridge.

5.0 REPAIR AND MAINTENANCE

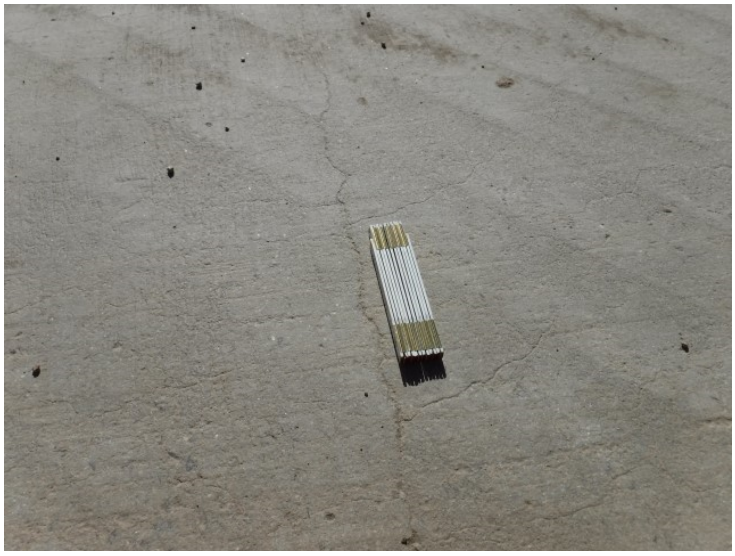
As identified previously, fourteen bridges had Valuation Scores below 0.700. The remaining life of these bridges is uncertain and will depend upon how they are maintained. When these bridges begin to reach the end of their service life, replacement efforts will represent a large financial burden to Elbert County. But only one bridge (ELBT-170-0.9-01) is beyond salvaging; concerted repair and maintenance efforts can keep most of the existing bridge inventory in place far longer than the current expected remaining life. This additional time will give Elbert County more flexibility to budget for the replacements and will allow the replacements to proceed at a more manageable pace.

Most of the older bridges in Elbert County are located on lightly traveled roads with no measurable truck traffic. If the integrity of the structure is maintained, these bridges should never see degradation due to loading conditions. The largest threat to their health will be corrosion, primarily due to water penetration and rusting of the reinforcing steel within concrete members. Corrosion of steel piles could also shorten the lives of these bridges. However, as previously noted, the safety of the approach and bridge rails is a large concern.

Protecting the steel piles from corrosion is straightforward. The existing corrosion should be sand blasted off the piles and the piles should then be painted to prevent further corrosion. This is a low-cost solution which should only need to be performed every 15 to 20 years. Protecting concrete girders and decks from corrosion is an important preventative measure that is critical to maintaining the existing bridge inventory. This asset management plan will focus on two methods to protect concrete components: sealing and patching.

Concrete sealing should be done on all bridges that have bare concrete decks without longitudinal joints to prevent water intrusion into the deck. Water intrusion will cause corrosion of reinforcing steel eventually, which will lead to spalling and cracking of the deck. Loss of deck integrity will have a negative impact on the girders below by allowing water and chlorides to reach them as well. Applying a silane based water repellent is an inexpensive solution, and the application can be performed by an Elbert County employee with minimal cost. Silane sealant lasts 8 to 10 years and is the easiest way to waterproof bridge decks. Concrete sealing is not suggested on the double tee girders without decks. The open longitudinal joints allow water to run down the faces of the girders and reach the bottoms of the girder stems. This will occur even if the top of the girder flange is sealed. Sealing the longitudinal joints is also not recommended. These joints do not have the structural capacity to maintain a connection between the girders as they flex under load, and traffic loading will cause them to fail again.

Figure 5.1 Typical Map Cracking in Bare Concrete Deck



Concrete patching should be done on bridge decks and in girders where spalls have exposed primary reinforcing. Most concrete spalls occur when corroding reinforcing steel expands and creates internal pressure on the surrounding concrete. Spalling will occur in discrete locations, but the steel corrosion underlying the spalls may be more widespread than is apparent. Simply grouting over the spall will cover the exposed reinforcing steel, but it may not slow the rate of steel corrosion. Including anodic protection in the spall repair will stop the corrosion process in that area, maintaining the current area of reinforcing steel and protecting the repair from failure. This is critical to conserving the load carrying capacity of the girders. Once reinforcing steel is lost, particularly prestressed steel, it can be impossible to restore the original capacity of the girders without significant cost ramifications.

Anodic protection is an inexpensive repair option which is easy to install. Sacrificial anodes can be wired onto the exposed reinforcing steel prior to placing the concrete patch to protect the steel reinforcing for 10 or more years. It is recommended that Elbert County request a manufacturer's representative to demonstrate the proper installation procedure for sacrificial anodes. Once trained, Elbert County staff can install the sacrificial anodes themselves for little cost. Repairing concrete spalls with sacrificial anodes may be the single most useful repair task for extending the life of the Elbert County bridges.

5.1 PRIORITIZATION MATRIX

Recommended maintenance and repair items are included in the inspection reports for each bridge, but no advice is provided to identify which items are of the most importance and which can be delayed. With limited maintenance funding, it is important to identify which repair items should take priority. A prioritization matrix was created for the structures in Elbert County which ranked each maintenance or repair task based on its criticality and its urgency. Emergency repairs were given the highest priority, followed by general repair items, then minor repairs, and finally basic maintenance or aesthetic

improvements. More important structural components, such as girders and the substructure, were also given higher priority relative to less critical elements such as the approach roadway and the stream channel. A summary of the baseline prioritization scores is shown below in Table 5.1. In this table, “1” is the highest priority and “20” is the lowest priority.

Table 5.1 Baseline Prioritization Scoring

	Emergency	General Repairs/ General Safety	Minor Structural/ Functional Improvements	Basic Maintenance/ Aesthetics
Structure Replacement	1	2	N/A	N/A
Girder Repairs	1	3	7	15
Substructure Repairs	1	4	8	16
Railing Repairs/Replacement	1	5	11	17
Deck Repairs	1	6	12	18
Approach Roadway Improvements	1	9	13	19
Channel Improvements	1	10	14	20

The scores were then modified to account for the urgency of the maintenance or repair tasks. Repairs requiring immediate work use the scores shown in Table 5.1. Repairs or maintenance that should ideally be performed in 1-5 years multiplies each cell in Table 5.1 by a factor of 2. Repairs or maintenance tasks performed in 6-20 years multiplies each cell by 4, and tasks that can wait more than 20 years multiply the cells by 8. A complete table showing all of the possible priority codes can be found in Appendix D.

Prioritization scores for each bridge may be found on the Graphic Sheets for those bridges. These scores designate the recommended priority for which funding should be allocated. If an item is listed under 1-5 years at priority 18 vs something at 20+ years at priority 16, then it is more important to start saving money for the 20+ event (which might be very expensive) than to spend money now on the 1-5 year item.

6.0 CONCLUSION

Elbert County is responsible for 34 major structures in their transportation system. The usage, current condition, and needs of these bridges vary across the county. The western part of the county sees higher traffic volume and typically has younger bridges designed to more modern standards. The eastern part of the county is comprised of older bridges that are in varying stages of structural deterioration and do not meet current standards for safety or roadway construction. However, the eastern bridges carry very light traffic with few trucks, and traffic will have a small impact on their remaining useful life. An asset management plan is necessary to identify, prioritize, and plan for current and future needs of both the western and eastern structures.

Conclusion

A practical approach to asset management must consider the county's budget and use the available funding in the most efficient way possible. One effective cost saving measure is to determine which bridges can be replaced with less costly structures. When site conditions and hydraulic requirements allow it, culverts and low water crossings are an inexpensive alternative to bridge replacements. Of the existing 31 bridges, it is recommended that 7 be replaced with culvert and 6 be replaced with low water crossings once the existing structures have reached the end of their service life. The estimated construction cost savings from using culverts and low water crossings is approximately $5.8 million.

Cost savings are not limited to replacement alternatives. The most effective cost-saving measure is being proactive about maintenance and repair operations. Repairing concrete spalls as soon as they're identified will prevent further corrosion of the steel reinforcing, which cannot be cost-effectively replaced once it has corroded away. Waterproofing concrete bridge decks will prevent chlorides and moisture form permeating into the concrete and will help to protect both the deck and the supporting girders from deterioration.

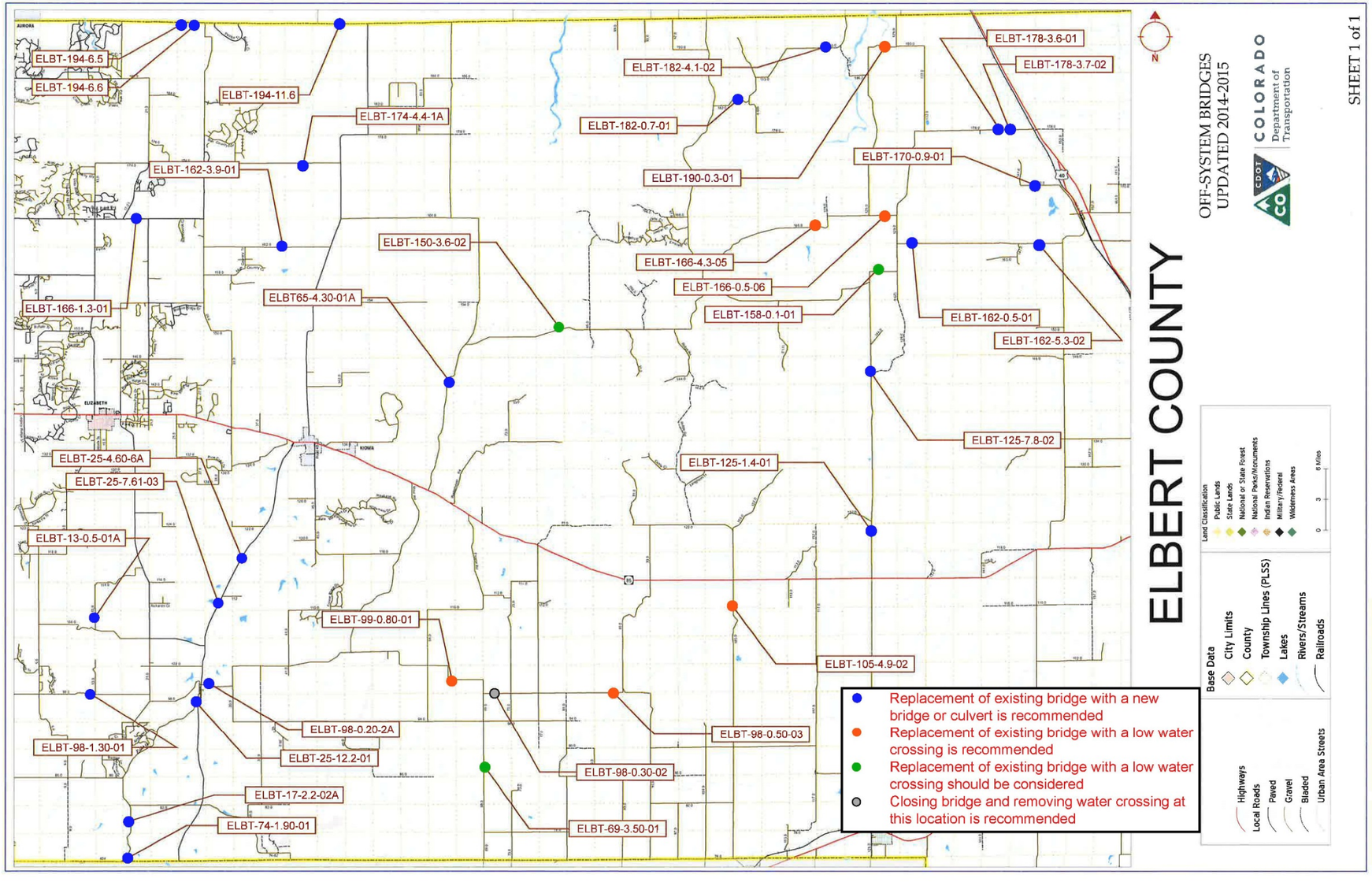
While an aggressive maintenance program will require an increased short-term budget, the long-term benefits will more than cover the costs. If the existing bridges are allowed to deteriorate at their current rate, the 20 oldest bridges will likely need to be replaced within the next 20 years. Using the most cost-efficient replacement alternatives, these replacements would cost the County $9.5 million at an average cost of $475,000 per year. But if the existing bridges are well-maintained, their useful life could be greatly extended, particularly for those bridges that see very little traffic. While the total replacement cost will not diminish, the per year cost of saving for those replacements will decrease dramatically as the existing bridges are kept in service longer.

Appendix A REPLACEMENT ALTERNATIVES

Table A.1 Replacement Matrix

Bridge Name	Bridge/ Culvert	Bridge/Superstructure Replacement					Low Water Crossing					Bridge Closure (only considered for local and minor collectors)				
		Feasibility	Cost	Impact	Impact Factor	Total Score	Feasibility	Cost	Impact	Impact Factor	Total Score	Feasibility	Cost	Impact	Impact Factor	Total Score
ELBT-13-0.5-01A	B	10	4	10	1.30	27	4	8	8	1.30	22.4	8	10	3	1.30	21.9
ELBT-17-2.2-02A	B	10	3	10	1.30	26	5	8	8	1.30	23.4	8	10	3	1.30	21.9
ELBT-25-4.60-6A	C	9	8	10	1.38	30.8	5	9	4	1.38	19.5	Not considered				
ELBT-25-7.61-03	C	9	8	10	1.38	30.8	5	9	4	1.38	19.5	Not considered				
ELBT-25-12.2-01	B	9	1	10	1.38	23.8	3	8	4	1.38	16.5	Not considered				
ELBT-65-4.30-01A	C	10	6	10	1.05	26.5	6	9	6	1.05	21.3	8	9	1	1.05	18.1
ELBT-69-3.50-01	C	10	7	10	1.00	27	8	9	8	1.00	25.0	9	10	4	1.00	23.0
ELBT-74-1.90-01	C	10	7	10	1.30	30	5	8	8	1.30	23.4	8	10	2	1.30	20.6
ELBT-98-0.20-2A	C	8	9	10	1.21	29.1	Current structure is close to low water crossing					8	9	1	1.21	18.2
ELBT-98-0.30-02	B	9	2	10	1.05	21.5	7	8	8	1.05	23.4	9	10	7	1.05	26.4
ELBT-98-0.50-03	B	9	5	10	1.05	24.5	7	8	9	1.05	24.5	8	10	7	1.05	25.4
ELBT-98-1.30-01	C	10	8	10	1.30	31	4	8	7	1.30	21.1	8	10	2	1.30	20.6
ELBT-99-0.80-01	B	10	3	10	1.05	23.5	7	8	8	1.05	23.4	8	10	2	1.05	20.1
ELBT-105-4.9-02	B	10	3	10	1.00	23	9	8	8	1.00	25.0	8	10	3	1.00	21.0
ELBT-125-1.4-01	B	10	4	10	1.05	24.5	3	7	7	1.05	17.4	8	10	1	1.05	19.1
ELBT-125-7.8-02	B	10	3	10	1.05	23.5	5	7	7	1.05	19.4	8	10	1	1.05	19.1
ELBT-150-3.6-02	B	10	1	10	1.05	21.5	5	7	7	1.05	19.4	8	9	1	1.05	18.1
ELBT-158-0.1-01	B	10	3	10	1.05	23.5	5	8	7	1.05	20.4	8	10	2	1.05	20.1
ELBT-162-0.5-01	B	10	6	10	1.05	26.5	3	8	8	1.05	19.4	8	10	2	1.05	20.1
ELBT-162-3.9-01	B	10	3	10	1.15	24.5	7	7	7	1.15	22.1	8	10	1	1.15	19.2
ELBT-162-5.3-02	B	10	5	10	1.05	25.5	5	8	8	1.05	21.4	8	10	2	1.05	20.1
ELBT-166-0.5-06	B	9	4	10	1.00	23	7	7	9	1.00	23.0	8	10	3	1.00	21.0
ELBT-166-1.3-01	B	10	4	10	1.37	27.7	4	8	5	1.37	18.8	8	9	1	1.37	18.4
ELBT-166-4.3-05	B	10	5	10	1.00	25	9	9	9	1.00	27.0	8	10	7	1.00	25.0
ELBT-170-0.9-01	C	7	7	10	1.00	24	Current structure is close to low water crossing					Not considered				
ELBT-174-4.4-1A	B	10	2	10	1.61	28.1	4	7	4	1.61	17.4	Not considered				
ELBT-178-3.6-01	C	10	6	10	1.00	26	6	8	8	1.00	22.0	8	10	3	1.00	21.0
ELBT-178-3.7-02	B	10	5	10	1.00	25	5	7	8	1.00	20.0	8	10	3	1.00	21.0
ELBT-182-0.7-01	C	9	6	10	1.00	25	3	8	7	1.00	18.0	8	10	1	1.00	19.0
ELBT-182-4.1-02	B	9	6	10	1.00	25	4	8	7	1.00	19.0	8	10	1	1.00	19.0
ELBT-190-0.3-01	B	10	3	10	1.00	23	7	8	8	1.00	23.0	9	10	3	1.00	22.0
ELBT-194-6.5	B	10	6	10	1.82	34.2	5	8	2	1.82	16.6	Not considered				
ELBT-194-6.6	B	10	5	10	1.82	33.2	5	8	2	1.82	16.6	Not considered				
ELBT-194-11.6	B	10	4	10	1.38	27.8	5	7	4	1.38	17.5	Not considered				

Figure A.1 Replacement Recommendations Map



Appendix B VALUATION SCORING

Table B.1 Valuation Score and Replacement Priority

Bridge Name	Sufficiency Rating	Current Age	ADT	Future ADT (2037)	% Trucks	1 Lane or 2?	Dev Pressure	Sufficiency	Age	ADT	Deter-ioration	Valuation	Valuation Rating	Valuation Ranking (1 = Most Adequate)	Estimated Remaining Life	Replacement Priority
ELBT-170-0.9-01	54.3	99	19	31	0	1	Low	11	0	5	0	16	0.400	34	5	7
ELBT-166-1.3-01	67.9	40	3916	6227	0	2	High	14	5	0	2	21	0.525	33	10	1
ELBT-125-1.4-01	70.9	54	33	52	0	1	Low	14	3	5	2	24	0.600	32	10	2
ELBT-162-0.5-01	70.9	53	68	108	0	1	Low	14	3	5	3	25	0.625	31	15	9
ELBT-69-3.50-01	82	53	65	103	0	1	Low	16	3	5	2	26	0.650	24	10	3
ELBT-98-0.50-03	82	53	21	33	0	1	Low	16	3	5	2	26	0.650	24	15	8
ELBT-158-0.1-01	70.9	53	22	34	0	1	Low	14	3	5	4	26	0.650	24	15	12
ELBT-162-5.3-02	71	53	76	121	0	1	Low	14	3	5	4	26	0.650	24	15	12
ELBT-178-3.6-01	71	54	32	51	0	1	Low	14	3	5	4	26	0.650	24	15	12
ELBT-178-3.7-02	71	54	32	51	0	1	Low	14	3	5	4	26	0.650	24	15	12
ELBT-190-0.3-01	70	54	22	35	0	1	Low	14	3	5	4	26	0.650	24	15	16
ELBT-105-4.9-02	82	53	95	151	0	1	Low	16	3	5	3	27	0.675	21	10	4
ELBT-125-7.8-02	82	54	25	40	0	1	Low	16	3	5	3	27	0.675	21	15	10
ELBT-166-0.5-06	82	54	24	38	0	1	Low	16	3	5	3	27	0.675	21	15	10
ELBT-98-0.30-02	82	53	51	81	0	1	Low	16	3	5	4	28	0.700	18	20	17
ELBT-182-0.7-01	82	53	17	27	0	1	Low	16	3	5	4	28	0.700	18	10	6
ELBT-194-11.6	89.6	54	242	384	1	2	Mod	18	3	5	2	28	0.700	18	10	5
ELBT-25-12.2-01	78.9	31	1745	2775	6	2	Mod	16	7	3	3	29	0.725	13	20	21
ELBT-99-0.80-01	82	53	71	112	0	1	Low	16	3	5	5	29	0.725	13	15	19
ELBT-162-3.9-01	77.9	52	143	227	0	1	Mod	16	4	5	4	29	0.725	13	15	18
ELBT-166-4.3-05	82	53	13	21	0	1	Low	16	3	5	5	29	0.725	13	20	22
ELBT-182-4.1-02	82	53	23	36	0	1	Low	16	3	5	5	29	0.725	13	15	20
ELBT-25-7.61-03	96.4	39	1473	2343	6	2	Mod	19	5	3	5	32	0.800	11	20	23
ELBT-194-6.5	99.9	37	1528	2429	9	2	High	20	6	3	3	32	0.800	11	30	24
ELBT-194-6.6	94.3	37	1528	2429	9	2	High	19	6	3	5	33	0.825	10	40	26
ELBT-25-4.60-6A	99.4	20	1473	2343	6	2	Mod	20	8	3	5	36	0.900	7	40	27
ELBT-98-0.20-2A	96.9	16	467	743	6	2	Mod	19	8	4	5	36	0.900	7	35	25
ELBT-150-3.6-02	99.7	28	239	380	0	2	Low	20	7	5	4	36	0.900	7	50	28
ELBT-13-0.5-01A	99	30	24	39	0	2	High	20	7	5	5	37	0.925	1	50	34
ELBT-17-2.2-02A	100	30	89	142	0	2	High	20	7	5	5	37	0.925	1	50	29
ELBT-65-4.30-01A	97.8	31	306	486	4	2	Low	20	7	5	5	37	0.925	1	50	33
ELBT-74-1.90-01	100	29	78	124	0	2	High	20	7	5	5	37	0.925	1	50	29
ELBT-98-1.30-01	100	28	240	382	0	2	High	20	7	5	5	37	0.925	1	50	29
ELBT-174-4.4-1A	99.9	26	188	299	0	2	Mod	20	7	5	5	37	0.925	1	50	32

Appendix C COST ESTIMATION

Table C.1 Cost Estimate Summary - Bridge Replacement

Bridge Name	Superstructure Type	Cost of Main Bridge Components	Area of Bridge (SF)	Bridge Cost/SF	Length of Bridge	Multiplier	Est. Cost of Bridge Demo	Cost of Replacement
ELBT-17-2.2-02A	Box Beams	$720,772	5494.4	$131	171.7	1.25	$75,000	$976,000
ELBT-65-4.30-01A	Box Beams	$538,607	3360	$160	105	1.5	$50,000	$858,000
ELBT-98-0.50-03	Box Beams	$343,316	2000	$172	100	1.5	$50,000	$565,000
ELBT-99-0.80-01	Box Beams	$697,317	4320	$161	180	1.25	$100,000	$972,000
ELBT-105-4.9-02	Box Beams	$657,221	4396	$150	219.8	1.25	$100,000	$922,000
ELBT-125-1.4-01	Box Beams	$652,512	4800	$136	200	1.25	$75,000	$891,000
ELBT-125-7.8-02	Box Beams	$694,437	4320	$161	180	1.25	$75,000	$943,000
ELBT-150-3.6-02	Box Beams	$1,253,291	9404.8	$133	293.9	1.25	$100,000	$1,667,000
ELBT-158-0.1-01	Box Beams	$691,477	4320	$160	180	1.25	$75,000	$939,000
ELBT-162-0.5-01	Box Beams	$219,221	1440	$152	60	1.75	$50,000	$434,000
ELBT-162-3.9-01	Box Beams	$700,762	4824	$145	201	1.25	$75,000	$951,000
ELBT-162-5.3-02	Box Beams	$493,607	3360	$147	140	1.25	$75,000	$692,000
ELBT-166-0.5-06	Box Beams	$551,647	3840	$144	160	1.25	$75,000	$765,000
ELBT-166-1.3-01	Box Beams	$506,232	3833.6	$132	119.8	1.5	$100,000	$859,000
ELBT-166-4.3-05	Box Beams	$485,653	3200	$152	160	1.25	$75,000	$682,000
ELBT-174-4.4-1A	Box Beams	$949,035	7110.4	$133	222.2	1.25	$100,000	$1,286,000
ELBT-178-3.6-01	Box Beams	$294,011	1920	$153	80	1.5	$50,000	$491,000
ELBT-178-3.7-02	Box Beams	$402,811	2400	$168	100	1.5	$50,000	$654,000
ELBT-182-0.7-01	Box Beams	$170,275	967.2	$176	40.3	1.75	$50,000	$348,000
ELBT-182-4.1-02	Box Beams	$169,591	960	$177	40	1.75	$50,000	$347,000
ELBT-190-0.3-01	Box Beams	$813,462	5760	$141	240	1.25	$75,000	$1,092,000
ELBT-194-6.5	Box Beams	$201,964	1159.2	$174	32.2	1.75	$100,000	$453,000
ELBT-194-6.6	Box Beams	$319,614	2257.2	$142	62.7	1.75	$100,000	$659,000
ELBT-194-11.6	Box Beams	$606,033	4200	$144	150	1.25	$100,000	$858,000

Bridge Name	Superstructure Type	Cost of Main Bridge Components	Area of Bridge (SF)	Bridge Cost/SF	Length of Bridge	Multiplier	Est. Cost of Bridge Demo	Cost of Replacement
ELBT-13-0.5-01A	Bulb-Tees	$440,147	3033.3	$145	104	1.5	$75,000	$735,000
ELBT-25-12.2-01	Bulb-Tees	$674,229	4185	$161	135	1.75	$125,000	$1,305,000

Table C.2 Cost Estimate Summary - Culvert Replacement

Bridge Name	Structure Type	Notes: # and Size of Culverts	Cost of Soil and Culvert	Multiplier	Est. Cost of Bridge Demo	Cost of Replacement
ELBT-25-4.60-6A	Culvert	(3) - 84" CMP	$117,000	1.25	$25,000	$171,000
ELBT-25-7.61-03	Culvert	(3) - 72" CMP	$101,000	1.25	$25,000	$151,000
ELBT-65-4.30-01A	Culvert	(5) - 120" CMP	$263,000	1.25	$50,000	$379,000
ELBT-69-3.50-01	Culvert	(4) - 84" CMP	$137,000	1.25	$75,000	$246,000
ELBT-74-1.90-01	Culvert	(4) - 84" CMP	$114,000	1.25	$75,000	$218,000
ELBT-98-0.20-2A	Culvert	(6) - 36" CMP	$42,000	1.25	$10,000	$63,000
ELBT-98-1.30-01	Culvert	(4) - 84" CMP	$109,000	1.25	$50,000	$186,000
ELBT-170-0.9-01	Culvert	(4) - 12'x8' Concrete Box	$133,000	1.5	$25,000	$225,000
ELBT-178-3.6-01	Culvert	(5) - 132" CMP	$238,000	1.25	$50,000	$348,000
ELBT-182-0.7-01	Culvert	(5) - 84" CMP	$206,000	1.25	$50,000	$308,000
ELBT-182-4.1-02	Culvert	(7) - 114" CMP	$297,000	1.25	$50,000	$421,000

Table C.3 Cost Estimate - Low Water Crossing

Bridge Name	Length of Riprap (ft)	Width of Grouted Riprap (ft)	Depth of Riprap (ft)	Unit Cost/CY Grouted Riprap	Cost of Riprap	Length of ABC Road Base (ft)	Width of ABC (ft)	Unit Cost/CY	Cost of Road Base	Length of Culverts (ft)	# of Pipes	Unit Cost/LF	Cost of Culverts	Multiplier	Est. Cost of Bridge Demo	Cost of Structure
ELBT-98-0.50-03	80	8	4	300	$28,444	100	18	150	$10,000	30	6	55	$9,900	1.2	$50,000	$108,000
ELBT-99-0.80-01	120	8	4	300	$42,667	180	20	150	$20,000	32	8	55	$14,080	1.2	$100,000	$192,000
ELBT-105-4.9-02	120	8	4	300	$42,667	220	18	150	$22,000	30	6	55	$9,900	1.2	$100,000	$189,000
ELBT-166-0.5-06	140	12	4	300	$74,667	160	20	150	$17,778	32	8	80	$20,480	1.2	$75,000	$211,000
ELBT-166-4.3-05	0	0	0	300	$0	160	18	150	$16,000	0	0	55	$0	1.2	$75,000	$94,000
ELBT-190-0.3-01	0	0	0	300	$0	240	21	150	$28,000	0	0	55	$0	1.2	$75,000	$109,000

Table C.4 Major Structure Replacement - Quantities Estimation

		Channel Depth (below bottom chord)													
Bridge Name	Length	Abut 1	1/3 or P1	Middle	2/3 or last P	Abut 2	# Spans (Replacement)	Proposed Travelway	Proposed Out-to-Out	Skew Angle	Box, Culvert, Girder?	Max Span Length (ft)	Length of Caps (ft)	# of Piles per Substructure	# of Piles (Total)
ELBT-13-0.5-01A	104	0.5	-	-	-	1.5	1	26.25	29.17	45	G	104	41.25	7	14
ELBT-17-2.2-02A	171.7	2.1	8.4	-	7.2	2.1	3	30.17	33.17	0	B	57.23	33.17	5	20
ELBT-25-4.60-6A		(3) - 7' dia CMPs								0	C		0.00		
ELBT-25-7.61-03		(1) - 5' and (2) - 6' dia CMPs								19	C		0.00		
ELBT-25-12.2-01	135	1.3	-	-	-	1.3	1	28.00	31.00	45	G	135	43.84	7	14
ELBT-65-4.30-01A	105	1.8	-	-	-	3.2	1	28.00	30.50	38	C	105	38.71	7	14
ELBT-69-3.50-01	160	4.9	-	10.2	-	0	2	26.25	29.17	0	C	80	29.17		
ELBT-74-1.90-01	150.8	1.8	-	9.6	-	1.8	2	28.17	31.25	0	C	75.4	31.25		
ELBT-98-0.20-2A		(6) - 3' dia CMPs								0	C		0.00		
ELBT-98-0.30-02	180	9.1	10.9	-	12.1	6.7	3				Close		0.00		
ELBT-98-0.50-03	100	6	-	-	-	5.4	1	17.67	20.67	0	B	100	20.67	4	8
ELBT-98-1.30-01	85.3	7.3	-	-	-	8.3	1	30.25	32.75	0	C	85.3	32.75		
ELBT-99-0.80-01	180	4.8	-	20.9	-	6.8	2	21.83	24.83	0	B	90	24.83	4	12
ELBT-105-4.9-02	219.8	7.2	7.9	-	5.7	4.7	3	17.67	20.67	0	B	73.27	20.67	4	16
ELBT-125-1.4-01	200	5.2	7.9	-	13	16	3	21.83	24.83	0	B	66.67	24.83	4	16
ELBT-125-7.8-02	180	7.8	-	10	-	7.5	2	21.83	24.83	0	B	90	24.83	4	12
ELBT-150-3.6-02	293.9	1.6	14.9	15.3	16	1.6	4	28.17	31.25	0	B	73.48	31.25	5	25
ELBT-158-0.1-01	180	5.1	-	9.4	-	3.4	2	21.83	24.83	0	B	90	24.83	4	12
ELBT-162-0.5-01	60	4.9	-	-	-	9.5	1	21.83	24.83	0	B	60	24.83	4	8
ELBT-162-3.9-01	201	9.5	10.7	-	7.9	6.2	3	21.83	24.83	0	B	80	24.83	4	16
ELBT-162-5.3-02	140	5.4	-	13.2	-	4.5	2	21.83	24.83	0	B	70	24.83	4	12
ELBT-166-0.5-06	160	6.1	-	11.3	-	7.8	2	21.83	24.83	0	B	80	24.83	4	12
ELBT-166-1.3-01	119.8	0.4	-	7.5	-	0.4	2	29.50	32.50	0	B	59.9	32.50	5	15
ELBT-166-4.3-05	160	8	-	12.3	-	10	2	17.67	20.67	0	B	80	20.67	4	12
ELBT-170-0.9-01	71	5.2	-	-	-	0.2	1	21.83	24.83	0	C	71	24.83		
ELBT-174-4.4-1A	222.2	0.2	10.5	-	12.3	3.4	3	27.58	30.58	15	B	74.07	31.66	5	20
ELBT-178-3.6-01	80	3.9	-	-	-	2	1	21.83	24.83	0	C	80	24.83	5	10
ELBT-178-3.7-02	100	8.3	-	-	-	4.8	1	21.83	24.83	0	B	100	24.83	5	10
ELBT-182-0.7-01	40.3	9.7	-	-	-	9.5	1	21.83	24.83	0	C	40.3	24.83	4	8
ELBT-182-4.1-02	40	10	-	-	-	9.2	1	21.83	24.83	0	B	40	24.83	4	8
ELBT-190-0.3-01	240	8.1	12.3	-	10.9	9.3	3	21.83	24.83	0	B	80	24.83	4	16
ELBT-194-6.5	32.2	4.7	-	-	-	6	1	34.50	37.50	0	B	32.2	37.50	5	10
ELBT-194-6.6	62.7	4.5	-	-	-	6.4	1	34.50	37.50	0	B	62.7	37.50	6	12
ELBT-194-11.6	150	8.9	-	13.7	-	8.8	2	26.92	29.92	0	B	75	29.92	5	15

Table C.5 Major Structure Replacement - Quantities Estimation (Part 2)

Bridge Name	Type of Girder or Diameter of Culvert	# of Girders per Span	Girder Spacing (ft)	Overhang Width (ft)	# of Girders (Total)	Pile Embedment	Length of Pile				
							Abut 1	1/3 or P1	Middle	2/3 or last P	Abut 2
ELBT-13-0.5-01A	BT54	4	7.333	3.583	4	30	30.5	0	0	0	31.5
ELBT-17-2.2-02A	BX24x48	8			24	30	32.1	38.4	0	37.2	32.1
ELBT-25-4.60-6A						30					
ELBT-25-7.61-03						30					
ELBT-25-12.2-01	BT63	4	7.75	3.875	4	30	31.3	0	0	0	31.3
ELBT-65-4.30-01A	BX44x48	8			8	30	31.8	0	0	0	33.2
ELBT-69-3.50-01						30					
ELBT-74-1.90-01						30					
ELBT-98-0.20-2A						30					
ELBT-98-0.30-02						30					
ELBT-98-0.50-03	BX44x48	5			5	30	36	0	0	0	35.4
ELBT-98-1.30-01						30					
ELBT-99-0.80-01	BX44x48	6			12	30	34.8	0	50.9	0	36.8
ELBT-105-4.9-02	BX35x48	5			15	30	37.2	37.9	0	35.7	34.7
ELBT-125-1.4-01	BX24x48	6			18	30	35.2	37.9	0	43	46
ELBT-125-7.8-02	BX44x48	6			12	30	37.8	0	40	0	37.5
ELBT-150-3.6-02	BX35x48	8			32	30	31.6	44.9	45.3	46	31.6
ELBT-158-0.1-01	BX44x48	6			12	30	35.1	0	39.4	0	33.4
ELBT-162-0.5-01	BX24x48	6			6	30	34.9	0	0	0	39.5
ELBT-162-3.9-01	BX35x48	6			18	30	39.5	40.7	0	37.9	36.2
ELBT-162-5.3-02	BX35x48	6			12	30	35.4	0	43.2	0	34.5
ELBT-166-0.5-06	BX35x48	6			12	30	36.1	0	41.3	0	37.8
ELBT-166-1.3-01	BX24x48	8			16	30	30.4	0	37.5	0	30.4
ELBT-166-4.3-05	BX35x48	5			10	30	38	0	42.3	0	40
ELBT-170-0.9-01						30					
ELBT-174-4.4-1A	BX35x48	8			24	30	30.2	40.5	0	42.3	33.4
ELBT-178-3.6-01	BX35x48	6			6	30	33.9	0	0	0	32
ELBT-178-3.7-02	BX44x48	6			6	30	38.3	0	0	0	34.8
ELBT-182-0.7-01	BX24x48	6			6	30	39.7	0	0	0	39.5
ELBT-182-4.1-02	BX24x48	6			6	30	40	0	0	0	39.2
ELBT-190-0.3-01	BX35x48	6			18	30	38.1	42.3	0	40.9	39.3
ELBT-194-6.5	BX24x48	9			9	30	34.7	0	0	0	36
ELBT-194-6.6	BX24x48	9			9	30	34.5	0	0	0	36.4
ELBT-194-11.6	BX35x48	7			14	30	38.9	0	43.7	0	38.8

Table C.6 Major Structure Replacement - Quantities Estimation (Part 3)

The quantities shown below are total quantities for individual bid items. They will be used directly in the cost estimation of the main structural components.

Bridge Name	Area of Boxes (Total) SF	Linear Feet of Bulb-Tee Girders	Volume of Abut/Pier Caps (Total), CY	Linear Feet of Steel Piles	Linear Feet of Type 3 Bridge Rail	Volume of Deck (CY)	Length of Culverts (LF)
ELBT-13-0.5-01A		416	36.66	434	208	75	
ELBT-17-2.2-02A	5494.4		58.96	699	343.4	88	
ELBT-25-4.60-6A							86.17
ELBT-25-7.61-03							64.51
ELBT-25-12.2-01		540	38.97	438.2	270	104	
ELBT-65-4.30-01A	3360		34.40	455	210	50	80
ELBT-69-3.50-01							80
ELBT-74-1.90-01							60
ELBT-98-0.20-2A							62
ELBT-98-0.30-02							
ELBT-98-0.50-03	2000		18.37	285.6	200	32	
ELBT-98-1.30-01							65
ELBT-99-0.80-01	4320		33.11	490	360	69	
ELBT-105-4.9-02	4396		36.74	582	439.6	71	
ELBT-125-1.4-01	4800		44.15	648.4	400	77	
ELBT-125-7.8-02	4320		33.11	461.2	360	69	
ELBT-150-3.6-02	9404.8		69.44	997	587.8	142	
ELBT-158-0.1-01	4320		33.11	431.6	360	69	
ELBT-162-0.5-01	1440		22.07	297.6	120	23	
ELBT-162-3.9-01	4824		44.15	617.2	402	78	
ELBT-162-5.3-02	3360		33.11	452.4	280	54	
ELBT-166-0.5-06	3840		33.11	460.8	320	62	
ELBT-166-1.3-01	3833.6		43.33	491.5	239.6	61	
ELBT-166-4.3-05	3200		27.56	481.2	320	52	
ELBT-170-0.9-01							30
ELBT-174-4.4-1A	7110.4		56.29	732	444.4	105	
ELBT-178-3.6-01	1920		22.07	329.5	160	31	75
ELBT-178-3.7-02	2400		22.07	365.5	200	39	
ELBT-182-0.7-01	967.2		22.07	316.8	80.6	16	80
ELBT-182-4.1-02	960		22.07	316.8	80	16	80
ELBT-190-0.3-01	5760		44.15	642.4	480	92	
ELBT-194-6.5	1159.2		33.33	353.5	64.4	19	
ELBT-194-6.6	2257.2		33.33	425.4	125.4	37	
ELBT-194-11.6	4200		39.89	607	300	70	

Table C.7 Cost Estimate Calculations - Bridge Replacement

Bridge Name	Superstructure Type	Area of Boxes (Total), SF	Unit Cost/SF	Cost of Boxes	Volume of Caps (Total), CY	Unit Cost/CY	Cost of Abut /Pier Caps	Linear Feet of Steel Piles	Unit Cost/LF	Cost of Piles	Type 3 Railing (LF)	Unit Cost/LF	Cost of Railing	Volume Deck (CY)	Unit Cost/CY	Cost of Deck	Cost of Structure
ELBT-17-2.2-02A	Box Beams	5494.4	70	$384,608	58.96	1500	$88,444	699	100	$69,900	343.4	300	$103,020	88	850	$74,800	$720,772
ELBT-65-4.30-01A	Box Beams	3360	100	$336,000	34.40	1500	$51,607	455	100	$45,500	210	300	$63,000	50	850	$42,500	$538,607
ELBT-98-0.50-03	Box Beams	2000	100	$200,000	18.37	1500	$27,556	285.6	100	$28,560	200	300	$60,000	32	850	$27,200	$343,316
ELBT-99-0.80-01	Box Beams	4320	100	$432,000	33.11	1500	$49,667	490	100	$49,000	360	300	$108,000	69	850	$58,650	$697,317
ELBT-105-4.9-02	Box Beams	4396	80	$351,680	36.74	1500	$55,111	582	100	$58,200	439.6	300	$131,880	71	850	$60,350	$657,221
ELBT-125-1.4-01	Box Beams	4800	70	$336,000	44.15	1500	$66,222	648.4	100	$64,840	400	300	$120,000	77	850	$65,450	$652,512
ELBT-125-7.8-02	Box Beams	4320	100	$432,000	33.11	1500	$49,667	461.2	100	$46,120	360	300	$108,000	69	850	$58,650	$694,437
ELBT-150-3.6-02	Box Beams	9404.8	80	$752,384	69.44	1500	$104,167	997	100	$99,700	587.8	300	$176,340	142	850	$120,700	$1,253,291
ELBT-158-0.1-01	Box Beams	4320	100	$432,000	33.11	1500	$49,667	431.6	100	$43,160	360	300	$108,000	69	850	$58,650	$691,477
ELBT-162-0.5-01	Box Beams	1440	70	$100,800	22.07	1500	$33,111	297.6	100	$29,760	120	300	$36,000	23	850	$19,550	$219,221
ELBT-162-3.9-01	Box Beams	4824	80	$385,920	44.15	1500	$66,222	617.2	100	$61,720	402	300	$120,600	78	850	$66,300	$700,762
ELBT-162-5.3-02	Box Beams	3360	80	$268,800	33.11	1500	$49,667	452.4	100	$45,240	280	300	$84,000	54	850	$45,900	$493,607
ELBT-166-0.5-06	Box Beams	3840	80	$307,200	33.11	1500	$49,667	460.8	100	$46,080	320	300	$96,000	62	850	$52,700	$551,647
ELBT-166-1.3-01	Box Beams	3833.6	70	$268,352	43.33	1500	$65,000	491.5	100	$49,150	239.6	300	$71,880	61	850	$51,850	$506,232
ELBT-166-4.3-05	Box Beams	3200	80	$256,000	27.56	1500	$41,333	481.2	100	$48,120	320	300	$96,000	52	850	$44,200	$485,653
ELBT-174-4.4-1A	Box Beams	7110.4	80	$568,832	56.29	1500	$84,433	732	100	$73,200	444.4	300	$133,320	105	850	$89,250	$949,035
ELBT-178-3.6-01	Box Beams	1920	80	$153,600	22.07	1500	$33,111	329.5	100	$32,950	160	300	$48,000	31	850	$26,350	$294,011
ELBT-178-3.7-02	Box Beams	2400	100	$240,000	22.07	1500	$33,111	365.5	100	$36,550	200	300	$60,000	39	850	$33,150	$402,811
ELBT-182-0.7-01	Box Beams	967.2	70	$67,704	22.07	1500	$33,111	316.8	100	$31,680	80.6	300	$24,180	16	850	$13,600	$170,275
ELBT-182-4.1-02	Box Beams	960	70	$67,200	22.07	1500	$33,111	316.8	100	$31,680	80	300	$24,000	16	850	$13,600	$169,591
ELBT-190-0.3-01	Box Beams	5760	80	$460,800	44.15	1500	$66,222	642.4	100	$64,240	480	300	$144,000	92	850	$78,200	$813,462
ELBT-194-6.5	Box Beams	1159.2	70	$81,144	33.33	1500	$50,000	353.5	100	$35,350	64.4	300	$19,320	19	850	$16,150	$201,964
ELBT-194-6.6	Box Beams	2257.2	70	$158,004	33.33	1500	$50,000	425.4	100	$42,540	125.4	300	$37,620	37	850	$31,450	$319,614
ELBT-194-11.6	Box Beams	4200	80	$336,000	39.89	1500	$59,833	607	100	$60,700	300	300	$90,000	70	850	$59,500	$606,033

Bridge Name	Superstructure Type	Length of Bulb-Tees (LF)	Unit Cost/LF	Cost of Girders	Volume of Caps (Total), CY	Unit Cost/CY	Cost of Abut /Pier Caps	Linear Feet of Steel Piles	Unit Cost/LF	Cost of Piles	Type 3 Railing (LF)	Unit Cost/LF	Cost of Railing	Volume Deck (CY)	Unit Cost/CY	Cost of Deck	Cost of Structure
ELBT-13-0.5-01A	Bulb-Tees	416	375	$156,000	36.66	1500	$54,997	434	125	$54,250	208	300	$62,400	75	1500	$112,500	$440,147
ELBT-25-12.2-01	Bulb-Tees	540	600	$324,000	38.97	1500	$58,454	438.2	125	$54,775	270	300	$81,000	104	1500	$156,000	$674,229

Table C.8 Cost Estimate Calculations - Culvert Replacement

Bridge Name	Structure Type	Length of Culverts (LF)	# Pipes	Unit Cost/LF	Cost of Culvert Pipes	Volume Fill (CY)	Unit Cost/CY	Cost of Fill	Length of Guardrail (LF)	Unit Cost/LF	Cost of Guardrail	Cost of Culvert	Notes: # and Size of Culverts
ELBT-25-4.60-6A	Culvert	86.17	3	250	$64,625	288.8	160	$46,209	120	50	$6,000	$116,834	(3) - 84" CMP
ELBT-25-7.61-03	Culvert	64.51	3	200	$38,709	354.1	160	$56,650	120	50	$6,000	$101,358	(3) - 72" CMP
ELBT-65-4.30-01A	Culvert	80	5	400	$160,000	828.8	110	$91,163	240	50	$12,000	$263,163	(5) - 120" CMP
ELBT-69-3.50-01	Culvert	80	4	250	$80,000	441.2	110	$48,534	160	50	$8,000	$136,534	(4) - 84" CMP
ELBT-74-1.90-01	Culvert	60	4	250	$60,000	414.0	110	$45,541	160	50	$8,000	$113,541	(4) - 84" CMP
ELBT-98-0.20-2A	Culvert	62	6	55	$20,460	103.9	160	$16,628	100	50	$5,000	$42,088	(6) - 36" CMP
ELBT-98-1.30-01	Culvert	65	4	250	$65,000	347.6	110	$38,231	120	50	$6,000	$109,231	(4) - 84" CMP
ELBT-170-0.9-01	Culvert	30	-	4100	$123,000	36.6	110	$4,021	120	50	$6,000	$133,021	**(4) - 12'x8' CBC**
ELBT-178-3.6-01	Culvert	75	5	500	$187,500	347.6	110	$38,232	240	50	$12,000	$237,732	(5) - 132" CMP
ELBT-182-0.7-01	Culvert	80	5	250	$100,000	895.5	110	$98,500	160	50	$8,000	$206,500	(5) - 84" CMP
ELBT-182-4.1-02	Culvert	80	7	350	$196,000	807.6	110	$88,837	240	50	$12,000	$296,837	(7) - 114" CMP

Appendix D PRIORITIZATION MATRIX

Table D.1 Prioritization Matrix

	Immediate x1.0				1-5 Years x2.0				6-20 Years x4.0				20+ Years x8.0			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Structure Replacement	1	2	N/A	N/A	2	4	N/A	N/A	N/A	8	N/A	N/A	N/A	16	N/A	N/A
Girder Repairs	1	3	7	15	2	6	14	30	N/A	12	28	60	N/A	24	56	120
Substructure Repairs	1	4	8	16	2	8	16	32	N/A	16	32	64	N/A	32	64	128
Railing Repairs/Replacement	1	5	11	17	2	10	22	34	N/A	20	44	68	N/A	40	88	136
Deck Repairs	1	6	12	18	2	12	24	36	N/A	24	48	72	N/A	48	96	144
Approach Roadway Improvements	1	9	13	19	2	18	26	38	N/A	36	52	76	N/A	72	104	152
Channel Improvements	1	10	14	20	2	20	28	40	N/A	40	56	80	N/A	80	112	160

Improvement Activity			
A	**B**	**C**	**D**
Emergencies/ Hazards	General Repairs/ General Safety Improvements	Minor Structural/ Functional Improvements; Basic Safety Improvements	Basic Maintenance; Aesthetics; Minor Safety Improvements

Appendix E REPLACEMENT MATRIX NOTES

Priority Matrix Notes

13-0.5-01A

Bridge:

- Feasibility 10: Already a modern bridge structure. Site is close to cities (Castle Rock, Denver, Colorado Springs) and major roads (Route 25). Substructure could potentially be reused if maintained. No environmental impacts. Meets hydraulic requirements.
- Cost 4: Site is not remote. Only single span, and substructure could be reused.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 4: No constructability problems; 1/2 for site constraints (steeper banks and only one span would make dipping down into a low water crossing more difficult); water consistently flows through channel, so high environmental impact; does not satisfy hydraulic requirements, 1/2 for meeting requirements for functional level of road (rural local, but high development pressures).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Running Creek consistently carries water, and culvert size would not be trivial.
- Impact 8: Low ADT with 0% trucks. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 3: High impact to local community; 5 mile detour. However, road typically only serves nearby residents. Not the fastest through route.

17-2.2-02A

Bridge:

- Feasibility 10: Already a modern bridge structure. Site is close to cities (Castle Rock, Denver, Colorado Springs) and major roads (Route 25). Substructure could potentially be reused if maintained. No environmental impact. Meets hydraulic requirements.
- Cost 3: Site is not remote. Three spans, but substructure could be reused.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; no site constraints; water consistently flows through channel, so high environmental impact; does not satisfy hydraulic requirements; 1/2 for meeting requirements for functional level of road (rural local, but high development pressures).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is large, and culvert size would not be trivial.
- Impact 8: Low ADT with 0% trucks. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 3: High impact to local community; 7 mile detour. However, road typically only serves nearby residents. Not the fastest through route.

<u>25-4.60-6A</u>

Culvert:

- Feasibility 9: 1/2 for constructability to maintain traffic while replacing culverts, no site constraints, no environmental impact compared to existing conditions, satisfies hydraulic requirements, meets requirements for functional level of road.
- Cost 8: Inexpensive solution.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: 1/2 for constructability to maintain traffic while replacing culverts, no site constraints, 1/2 for environmental impact during flood events, 1/2 for satisfying hydraulic requirements (wash is typically dry), does not meet requirements for functional level of road.
- Cost 9: Least expensive construction (smaller diameter culverts), but repair costs will be high when washouts occur.
- Impact 4: High ADT with 6% trucks on a major collector with a long detour (10 miles). Even short-term closures for washout repairs would have a high impact.

Bridge Closure:

- Not considered due to importance of route.

<u>25-7.61-03</u>

Culvert:

- Feasibility 9: 1/2 for constructability to maintain traffic while replacing culverts, no site constraints, no environmental impact compared to existing conditions, satisfies hydraulic requirements, meets requirements for functional level of road.
- Cost 8: Inexpensive solution.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: 1/2 for constructability to maintain traffic while replacing culverts, no site constraints, 1/2 for environmental impact during flood events, 1/2 for satisfying hydraulic requirements (wash is typically dry), does not meet requirements for functional level of road.
- Cost 9: Least expensive construction (smaller diameter culverts), but repair costs will be high when washouts occur.
- Impact 4: High ADT with 6% trucks on a major collector with a long detour (10 miles). Even short-term closures for washout repairs would have a high impact.

Bridge Closure:

- Not considered due to importance of route.

25-12.2-01

Bridge:

- Feasibility 9: Already a modern bridge structure. Site is close to cities (Castle Rock, Denver, Colorado Springs) and is on a major road (Route 25). The substructure - at the very least the pier - might have to be replaced. Might have constructability issues maintaining traffic while replacing bridge since pier is a hammerhead. No environmental impacts. Meets hydraulic requirements.
- Cost 1: Site is not remote. Full bridge replacement would likely be required (2 spans).
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 3: Might have constructability issues maintaining traffic while replacing bridge since pier is a hammerhead; no site constraints; water consistently flows through channel, so high environmental impact; does not satisfy hydraulic requirements; does not meet requirements for functional level of road.
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. West Kiowa Creek frequently has water, and drainage basin is large; culvert size would not be trivial. Repair costs will be high when washouts occur.
- Impact 4: High ADT with 6% trucks on a major collector. Even short-term closures for washout repairs would have a high impact.

Bridge Closure:

- Not considered due to importance of route.

65-4.30-01A

Culvert:

- Feasibility 10: Already a modern bridge structure. Site is close to a major road (Route 86). Substructure could potentially be reused if maintained. No environmental impacts. Meets hydraulic requirements.
- Cost 6: Site is not remote. Only single span, and substructure could be reused if maintained, or could be replaced with culverts.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 6: No constructability problems; 1/2 for site constraints (steep banks and only one span would make dipping down into a low water crossing more difficult); 1/2 for environmental impact (only carries water seasonally, no wetlands under existing bridge); 1/2 for hydraulic requirements – tributary is usually dry but could carry a lot of water during a storm; 1/2 for meeting requirements for functional level of road.
- Cost 9: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 6: Moderate ADT with 4% trucks and long detour (10 miles). Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 9: Very little cost (demolition of existing structure). Bridge is on the fastest through route with 4% truck traffic, so impact to commerce needs to be considered.
- Impact 1: High impact to local community and through traffic. Fastest through route with 10 mile detour.

69-3.50-01

Culvert:

- Feasibility 10: Easily constructible. Batch plant in Limon is only 47 miles away; nearest precast yard in Colorado Springs is 42 miles away. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 7: Site is not remote. Could be replaced with culverts.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 8: No constructability problems; no site constraints – gradual banks would make low water crossing easier; 1/2 for environmental impact (only carries water seasonally, no wetlands under existing bridge); 1/2 for hydraulic requirements – tributary is usually dry but could carry a lot of water during a storm; would meet requirements for functional level of rural local road.
- Cost 9: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 8: Low ADT with 0% trucks. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 9: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, 1/2 for meeting requirements of functional level of road (rural local).
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 4: High impact to local community; 6 mile detour. However, road typically only serves nearby residents. Not the fastest through route, and would cause a significant increase in travel time to nearest communities (Kiowa, Elbert, Ramah, Peyton) to only a very small number of households. ADT is expected to be 103 in 2037.

74-1.90-01

Culvert:

- Feasibility 10: Easily constructible. Close to Colorado Springs. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 7: Site is not remote. Suggest replacing with culverts.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; no site constraints – gradual banks would make low water crossing easier; water consistently flows through channel, so high environmental impact; does not satisfy hydraulic requirements, 1/2 for meeting requirements for functional level of road (rural local, but high development pressures).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is large, and culvert size would not be trivial.
- Impact 8: Low ADT with 0% trucks. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road – road is only rural local, but also has high development pressures.
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 2: High impact to local community; 7 mile detour. Not the fastest through route and road typically only serves nearby residents, however this route may become a collector as area is developed in the future.

<u>98-0.20-2A</u>

Culvert:

- Feasibility 8: Easily constructible. No site constraints. No change in environmental impact. 1/2 for hydraulic requirements. 1/2 for meeting requirements for functional level of road: minor collector with moderate development pressure, but according to SI&A, Waterway Adequacy is “Slight chance of overtopping bridge deck and roadway approaches”.
- Cost 9: Culverts are very close to roadway surface and are small diameter (36”). Could be inexpensively replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- No significant difference between current structure and a low water crossing.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 9: Very little cost (demolition of existing structure). Bridge is on the fastest through route with 6% truck traffic, so impact to commerce needs to be considered.
- Impact 1: High impact to local community and through traffic. Fastest through route, moderate to high ADT, and 5 mile detour.

<u>98-0.30-02</u>

Bridge:

- Feasibility 9: Channel has degraded 3 ft since construction. Scour will need to be considered in design/construction. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.

- Cost 2: Site is not remote, but not very close to any major towns. Bridge is 5 spans. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 7: No constructability problems; 1/2 for site constraints – gradual banks at west end would make low water crossing easier, but bank is steep and at base of steep hill at east end; 1/2 for environmental impact (only carries water seasonally, no wetlands under existing bridge); 1/2 for hydraulic requirements – tributary is usually dry or low-flow but could carry a lot of water during a storm; meets requirements for functional level of road (minor collector, but detour would only be 2 miles if crossing needed to be repaired after flooding).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is large, and culvert size would not be trivial.
- Impact 8: Low ADT with 0% trucks. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 9: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, 1/2 for meeting requirements for functional level of road – road is a minor collector, but the detour is only 2 miles.
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 7: Very small impact to local community; only 2 mile detour. Small ADT (81 in 2037). SI&A report classifies CR-98 as a minor collector at this location, but Figure 4-2 in the West Elbert County Transportation Master Plan classifies the future use of this road as “rural local”.

<u>98-0.50-03</u>

Bridge:

- Feasibility 9: Channel has degraded or scoured near Pier 2 since construction. Scour will need to be considered in design/construction. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 5: Bridge is 100 feet long. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 7: No constructability problems; no site constraints; 1/2 environmental impact – might be some wetland vegetation under the bridge; does not satisfy hydraulic requirements; meets functional level of road.
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. High flows will need to be considered.
- Impact 9: Very low ADT (33 in 2037) with 0% trucks. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 7: Very small impact to community – with a current ADT of 21, bridge likely only serves residences in immediate vicinity of bridge, but a 6 mile detour is not trivial for local residents. CR-89 (N-S road immediately west of 98-0.50-03) is not a through route. The SI&A report is mistaken in referring to CR-98 as a collector between CR-89 and CR-77. Stantec drove this section of road while conducting site visits of all off-system bridges, and it is an unmaintained, high-clearance road with a manually operated gate at the intersection with CR-89. Figure 4-2 in West Elbert County Transportation Master Plan also identifies CR-98 as a collector over this stretch, but this would require a major road improvement and at least two hydraulic structures which are not in place.

<u>98-1.30-01</u>

Culvert:

- Feasibility 10: Already a modern bridge structure. Site is close to cities (Castle Rock, Denver, Colorado Springs) and major roads (Routes 83 and 25). Substructure could be reused if maintained. No environmental impacts. Meets hydraulic requirements.
- Cost 8: Site is not remote. Structure length is 85 feet, and substructure could be reused, or bridge could be replaced with a culvert.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 4: No constructability problems; 1/2 for site constraints (steeper banks and only one span would make dipping down into a low water crossing more difficult); water consistently flows through channel, so high environmental impact; does not satisfy hydraulic requirements; 1/2 for meeting requirements for functional level of road (rural local, but high development pressures).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Running Creek consistently carries water, and culvert size would not be trivial.
- Impact 7: Moderate ADT with 0% trucks. Crossing would not be usable during major storm events

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 2: High impact to local community; moderate ADT with 5 mile detour. However, road typically only serves nearby residents. Not the fastest through route.

<u>99-0.80-01</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.

- Cost 3: Site is not remote. Bridge is 180 feet long but could be shortened. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 7: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; meets requirements for functional level of road.
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is very large, and culvert size would not be trivial.
- Impact 8: Low ADT with 0% trucks. Crossing would not be usable during major storm events

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a minor collector, but ADT is low and truck traffic is 0%, so impact to commerce is negligible.
- Impact 2: High impact to local community. Low ADT with only 4 mile detour, but road is fastest through route.

<u>105-4.9-02</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 3: Site is not remote. Bridge is 220 feet long.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 9: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; channel is very wide and shallow. Low water crossing could be designed to allow most storm events to overtop road across a wide area without negatively impacting hydraulics; meets requirements for functional level of road (rural local).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is very large, and culvert size would not be trivial.
- Impact 8: Low ADT with 0% trucks. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 3: High impact to local community. Detour is 6 miles; ADT is low to moderate. Road is only rural local with low development pressure.

125-1.4-01

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 4: Site is not remote. Bridge is 200 feet long but could be shortened. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 3: No constructability problems; channel is very deep with steep banks; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; does not meet requirements for functional level of road.
- Cost 7: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is very large, and culvert size would not be trivial.
- Impact 7: Very low ADT with 0% trucks. Crossing would not be usable during major storm events (with a 14 mile detour)

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a minor collector, but ADT is very low and truck traffic is 0%, so impact to commerce is negligible.
- Impact 1: High impact to local community. Very low ADT, but detour is 14 miles long and road is fastest through route.

125-7.8-02

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 3: Site is not remote. Bridge is 180 feet long but could be shortened. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; 1/2 for site constraints – banks are slightly steep; no environmental impact – channel is usually dry; does not satisfy hydraulic requirements; does not meet requirements for functional level of road.
- Cost 7: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is very large, and culvert size would not be trivial.
- Impact 7: Very low ADT with 0% trucks. Crossing would not be usable during major storm events (with a 15 mile detour)

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.

- Cost 10: Very little cost (demolition of existing structure). Bridge is on a minor collector, but ADT is very low and truck traffic is 0%, so impact to commerce is negligible.
- Impact 1: High impact to local community. Very low ADT, but detour is 14 miles long and road is fastest through route.

<u>150-3.6-02</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 1: Site is not remote. Bridge is 300 feet long. Substructure could potentially be reused if the deck joints are maintained and the paint system is maintained on the piles but will likely need to be replaced based on the performance of similar substructures.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; does not meet requirements for functional level of road.
- Cost 7: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is very large, and culvert size would not be trivial.
- Impact 7: Moderate ADT with 0% trucks but very long (16 mile) detour. Crossing would not be usable during major storm events

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 9: Very little cost (demolition of existing structure). Bridge is on a minor collector, ADT is moderate, and detour length is 16 miles. But truck traffic is only 0%, so impact to commerce is minor.
- Impact 1: High impact to local community. Moderate ADT and detour is 16 miles long and road is fastest through route.

<u>158-0.1-01</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 3: Site is not remote. Bridge is 180 feet long. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; does not meet requirements for functional level of road.
- Cost 8: Inexpensive solution.
- Impact 7: Moderate ADT with 0% trucks but very long (14 mile) detour. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a minor collector and detour length is 16 miles, but ADT is very low and truck traffic is 0%, so impact to commerce is negligible.
- Impact 2: High impact to local community. Very low ADT, but detour is 14 miles long and road is fastest through route.

<u>162-0.5-01</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 6: Site is not remote. Bridge is only 60 feet long. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 3: No constructability problems; 1/2 for site constraints (steeper banks and only 60 foot existing structure length would make dipping down into a low water crossing more difficult); high environmental impact – large year-round pond and wetland under bridge; does not satisfy hydraulic requirements; does not meet requirements for functional level of road.
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 8: Low ADT with 0% trucks but long (9 mile) detour. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a minor collector and detour length is 9 miles, but ADT is low and truck traffic is 0%, so impact to commerce is negligible.
- Impact 2: High impact to local community. Low ADT, but detour is 9 miles long and road is fastest through route.

<u>162-3.9-01</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 3: Site is not remote. Bridge is 201 feet long. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 7: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; meets requirements for functional level of road (rural local).
- Cost 7: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is very large, and culvert size would not be trivial.
- Impact 7: Low to moderate ADT with 0% trucks, 6 mile detour. Crossing would not be usable during major storm events. Moderate development pressure, but only a rural local road.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 1: High impact to local community. Low to moderate ADT with 6 mile detour and moderate development pressure.

<u>162-5.3-02</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 5: Site is not remote. Bridge is 140 feet long. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; does not meet requirements for functional level of road.
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 8: Low ADT with 0% trucks but long (9 mile) detour. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a minor collector and detour length is 9 miles, but ADT is low and truck traffic is 0%, so impact to commerce is negligible.
- Impact 2: High impact to local community. Low ADT, but detour is 9 miles long and road is fastest through route.

<u>166-0.5-06</u>

Bridge:

- Feasibility 9: Scour will need to be considered in design/construction. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 4: Site is not remote. Bridge is 160 feet long. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 7: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; meets requirements for functional level of road (rural local).
- Cost 7: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 9: Very low ADT with 0% trucks and short detour (4 miles). Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a minor collector and detour length is 9 miles, but ADT is low and truck traffic is 0%, so impact to commerce is negligible.
- Impact 3: High impact to local community, but ADT is very low (38 in 2037), road is only a rural local with no development pressure. SI&A Report states that detour length is only 4 miles, but this may be a typo. A vehicle traveling from the vicinity of the CR-125/CR-166 intersection would have to add approximately 14 miles to its trip to reach Limon or other major destinations to the SE.

<u>166-1.3-01</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 4: Site is not remote. Bridge is 120 feet long. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 4: No constructability problems; no site constraints; high environmental impact; does not satisfy hydraulic requirements; does not meet requirements for functional level of road.
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 5: Very high ADT (6227 estimated for 2037). Crossing would not be usable during major storm events, which would have a major impact to transportation.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.

- Cost 9: Very little cost (demolition of existing structure). Bridge is on the fastest through route with an estimated 6227 cars a day in 2037, so impact to commerce needs to be considered.
- Impact 1: High impact to local community. ADT is very high (6227 in 2037) and road is fastest through route.

<u>166-4.3-05</u>

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 5: Site is remote. Bridge is 160 feet long. Substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 9: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; Low water crossing could be designed to allow most storm events to overtop road across a wide area without negatively impacting hydraulics; meets requirements for functional level of road (rural local).
- Cost 9: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 9: Very low ADT with 0% trucks and short detour (4 miles). Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). ADT is very low and truck traffic is 0%, so impact to commerce is negligible.
- Impact 7: High impact to local community, but the bridge likely only serves residences in immediate vicinity of bridge. The ADT is very low (estimated 21 in 2037). Road is only a rural local with no development pressure.

<u>170-0.9-01</u>

Culvert:

- Feasibility 7: 1/2 for constructability: road is a dead-end – it would add complexity to replace this bridge and maintain traffic; no site constraints; 1/2 for environmental impacts: standing water and wetlands surround bridge on all sides. Adding new substructure or replacing with culverts would impact environment; replacing in kind does not meeting hydraulic requirements: current waterway adequacy is a 4, “Occasional overtopping of bridge deck and roadway with significant traffic delays.” Replacement bridge would need to be raised and/or lengthened to improve hydraulics; meets requirements of functional level of road.
- Cost 7: Site is not remote. Bridge is 71 feet long but may need to be lengthened. Substructure would need to be replaced. Culverts (concrete or CMP) might be a viable alternative to a new bridge. Environmental sensitivity of site will have a large impact on project cost.

- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- The current structure is already similar to a low water crossing. Stream carries water close to the roadway elevation year-round. There would be no benefit to changing this to a low water crossing.

Bridge Closure:

- A bridge closure was not considered because this water crossing provides the only access to the community on the west side of the bridge.

174-4.4-1A

Bridge:

- Feasibility 10: Already a modern bridge structure. Site is close to cities (Castle Rock, Denver). No environmental impacts. Meets hydraulic requirements.
- Cost 2: Site is not remote. Substructure could potentially be reused if maintained.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 4: No constructability problems; no site constraints; water occasionally flows through channel and wetlands might exist in vicinity of bridge, so high environmental impact; does not satisfy hydraulic requirements; does not meet requirements for functional level of road (minor arterial).
- Cost 7: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. West Kiowa Creek frequently has water, and drainage basin is large; culvert size would not be trivial. Repair costs will be high when washouts occur.
- Impact 4: Only moderate ADT with 0% trucks, but bridge is on a minor arterial. Even short-term closures for washout repairs would have a high impact.

Bridge Closure:

- Not considered due to importance of route.

178-3.6-01

Culvert:

- Feasibility 10: Easily constructible. Site is adjacent to I-70. No site constraints. No change in environmental impacts. Meets hydraulic requirements.
- Cost 6: Site is not remote. Replace with culverts.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 6: No constructability problems; 1/2 for site constraints (steeper banks and only an 80 foot structure length would make dipping down into a low water crossing more difficult); high environmental impact; 1/2 for satisfying hydraulic requirements – low flow demands; meets requirements for functional level of road – ADT is low and road is only rural local
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.

- Impact 8: Low ADT with 0% truck traffic, but detour is 8 miles. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no change in environmental impact, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a rural local route, so impact to commerce is negligible.
- Impact 3: High impact to local community; low ADT on a rural local route with no development pressure, but 8 mile detour.

178-3.7-02

Bridge:

- Feasibility 10: Easily constructible. Site is adjacent to I-70. No site constraints. No change in environmental impacts. Meets hydraulic requirements.
- Cost 5: Site is not remote. Structure length is only 70 feet, but substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; 1/2 for site constraints (steeper banks and only an 70 foot structure length would make dipping down into a low water crossing more difficult); high environmental impact; does not satisfy hydraulic requirements; meets requirements for functional level of road – ADT is low and road is only rural local.
- Cost 7: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is very large, and culvert size would not be trivial.
- Impact 8: Low ADT with 0% truck traffic, but detour is 8 miles. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no change in environmental impact, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a rural local route, so impact to commerce is negligible.
- Impact 3: High impact to local community; low ADT on a rural local route with no development pressure, but 8 mile detour.

182-0.7-01

Culvert:

- Feasibility 9: Easily constructible, but material delivery to remote site might be difficult. No site constraints. No change in environmental impacts. Meets hydraulic requirements.
- Cost 6: Site is remote. Structure length is only 40 feet but may need to be lengthened dependent on a future hydraulic analysis. Substructure would need to be replaced. Bridge could potentially be replaced with culverts pending more refined hydraulic analysis.

- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 3: No constructability problems; 0/2 for site constraints – very steep banks and deep channel; high environmental impact; does not satisfy hydraulic requirements; 1/2 for meeting requirements for functional level of road – ADT is very low and road is only rural local, but detour is very long (15 miles).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 7: Very low ADT with 0% truck traffic, but detour is 15 miles. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no change in environmental impact, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a rural local route, so impact to commerce is negligible.
- Impact 1: High impact to local community; very low ADT (estimated 27 in 2037) on a rural local route with no development pressure, but detour is very long (15 miles).

<u>182-4.1-02</u>

Bridge:

- Feasibility 9: Easily constructible, but material delivery to remote site might be difficult. No site constraints. No change in environmental impacts. Meets hydraulic requirements.
- Cost 6: Site is remote. Structure length is only 40 feet but may need to be lengthened dependent on a future hydraulic analysis. Substructure would need to be replaced. Bridge could potentially be replaced with culverts pending more refined hydraulic analysis.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 4: No constructability problems; 1/2 for site constraints – steep banks over only a 40 foot structure length; high environmental impact; does not satisfy hydraulic requirements; 1/2 for meeting requirements for functional level of road – ADT is very low and road is only rural local, but detour is very long (15 miles).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 7: Very low ADT with 0% truck traffic, but detour is 15 miles. Crossing would not be usable during major storm events.

Bridge Closure:

- Feasibility 8: No constructability problems, no site constraints, no change in environmental impact, satisfies hydraulic requirements, does not meet requirements for functional level of road.
- Cost 10: Very little cost (demolition of existing structure). Bridge is on a rural local route, so impact to commerce is negligible.
- Impact 1: High impact to local community; very low ADT (estimated 36 in 2037) on a rural local route with no development pressure, but detour is very long (15 miles).

190-0.3-01

Bridge:

- Feasibility 10: Easily constructible. No site constraints. No change in environmental impact. Meets hydraulic requirements. Meets requirements of functional level of road.
- Cost 3: Site is not remote. Bridge is 240 feet long, and substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 7: No constructability problems; 1/2 for site constraints – very gradual bank at east end, but the west end has a steep approach road and steep bank and the existing channel is close to the west abutment. The channel may need to be moved for a low water crossing to work; 1/2 for environmental impact (only carries water seasonally, no wetlands under existing bridge); 1/2 for hydraulic requirements – tributary is usually dry but could carry a lot of water during a storm; would meet requirements for functional level of rural local road.
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 8: Very low ADT with 0% trucks. Crossing would not be usable during major storm events, but detour is only 4 miles.

Bridge Closure:

- Feasibility 9: No constructability problems, no site constraints, no environmental impacts, satisfies hydraulic requirements, 1/2 for meeting requirements of functional level of road (rural local with very low ADT).
- Cost 10: Very little cost (demolition of existing structure). Bridge is not on the fastest through route, so impact to commerce is negligible.
- Impact 3: High impact to local community; 4 mile detour. However, road typically only serves nearby residents (ADT is estimated at 35 in 2037). Bridge is on the fastest through route to Kiowa only for residents living within a few miles of the east end of the bridge. No significant change in travel time to Limon for nearest resident on west end of bridge, although travel times to Deer Trail or Byers would be increased by approximately 20 minutes.

194-6.5

Bridge:

- Feasibility 10: Already a modern bridge structure. Site is close to cities (Castle Rock, Denver). No environmental impacts. Meets hydraulic requirements.
- Cost 6: Site is not remote. Structure is only 32 feet long, and substructure could potentially be reused if maintained and if the current hydraulic opening is adequate.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; does not meet requirements for functional level of road (minor arterial).

- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 2: High ADT (estimated 2429 in 2037) with 9% trucks and CR-194 is expected to be a minor arterial in the future according to Figure 4-2 in the West Elbert County Transportation Master Plan. Even short-term closures for washout repairs would have a high impact.

Bridge Closure:

- Not considered due to importance of route.

194-6.6

Bridge:

- Feasibility 10: Already a modern bridge structure. Site is close to cities (Castle Rock, Denver). No environmental impacts. Meets hydraulic requirements.
- Cost 5: Site is not remote. Structure is 63 feet long, and substructure could potentially be reused if maintained.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; does not meet requirements for functional level of road (minor arterial).
- Cost 8: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms.
- Impact 2: High ADT (estimated 2429 in 2037) with 9% trucks and CR-194 is expected to be a minor arterial in the future according to Figure 4-2 in the West Elbert County Transportation Master Plan. Even short-term closures for washout repairs would have a high impact.

Bridge Closure:

- Not considered due to importance of route.

194-11.6

Bridge:

- Feasibility 10: Easily constructible; site is close to cities (Castle Rock, Denver); no environmental impacts; meets hydraulic requirements.
- Cost 4: Site is not remote. Structure is 150 feet long and substructure would need to be replaced.
- Impact 10: Replacing bridge in kind will not have a negative impact to the community.

Low Water Crossing:

- Feasibility 5: No constructability problems; no site constraints; 1/2 for environmental impact – water occasionally flows through channel; does not satisfy hydraulic requirements; does not meet requirements for functional level of road (major collector).
- Cost 7: Inexpensive solution. Cost is based on placement of minimum-sized culverts which could handle 1- to 5-year storms. Drainage basin is very large, and culvert size would not be trivial.

- Impact 4: Moderate ADT (estimated 384 in 2037) with 1% trucks. Short-term closures for washout repairs would have a negative impact to commerce.

Bridge Closure:

- Not considered due to importance of route.

ELBT-166-1.3-01

CR 166 over Running Creek

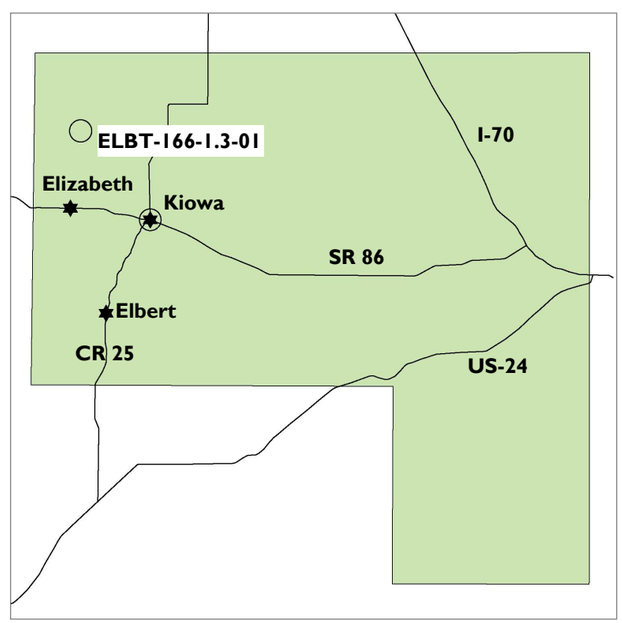
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Repair spalls at ends of Girders 1A, 2A, 1J, 2J	$6,000
8	Repair delaminated and spalled concrete at top of Pier 2	$7,500
8	Install deck joint over Pier 2 to direct water away from deteriorated beam ends	$1,700
8	Repair spalled and delaminated areas in Pier 2 wall at bearing locations	$19,000
16	Add steel corbels on both sides of Pier 2 to extend bearing seats	$6,000
20	Replace corroded guardrail posts	$12,000

Existing Structure Data

Age:	40 years (built 1978)
Structure Length:	119.8'
Width Out to Out:	32.5' (C/C 29.8')
No. of Lanes on Bridge:	2
Average Daily Traffic:	3916
Truck Traffic:	0%
Sufficiency Rating:	67.9
Deck Rating:	6
Superstructure Rating:	5
Substructure Rating:	5

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 1
- Estimated Remaining Life: 10 years (if no repairs are made)
- # of spans and total length: 2-span 120' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX24x48), 32'-6" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 12'-0" lane in each direction with 2'-9" shoulders on each side
- Estimated cost: $859,000

Photos of Existing Condition

Spall near the Pier 2 bearing location with exposed and corroded prestressing strand, typical at all exterior girders.

The existing exterior top flanges of the exterior girders are typically deteriorated with exposed wire mesh reinforcing.

Typical R2 corrosion at base of railing posts.

Spall in Pier 2 under Girder 2D bearing. Several old repairs to the pier are failing or have failed at the bearing locations.

Evaluations by Discipline

Structural:

The structure carries CR 166 over Running Creek. The deck has a "Satisfactory" condition rating, but the superstructure and substructure each have "Fair" condition ratings, indicating minor section loss.

The current average daily traffic is 3916 vehicles with no trucks. This is a heavy traffic load, but the absence of truck traffic reduces the impact to the structure. However, this bridge is in an area of high development pressure, and the traffic usage could change in the future to include trucks.

All four exterior girders have spalled at the base of the stem near the pier wall, and the exposed reinforcing in these areas is heavily corroded. Girders 1G and 1D have vertical and diagonal cracking at the base of the stem near the pier wall. Extensive spalling has occurred in the pier wall underneath and adjacent to the bearing locations with no exposed reinforcing. Spalling has also occurred in the pier diaphragm with exposed and corroded reinforcing. Two previous repairs to the pier walls have delaminated. There is also severe deterioration throughout the entire exterior top flanges and several areas of spalling at the edge of the deck.

These corrosion problems indicate extensive water intrusion into the concrete superstructure and substructure. Currently, no cracking or spalling has been observed near midspan, so the load carrying capacity of the bridge has not been diminished.

All unsound concrete needs to be removed from the spalled areas. Cathodic protection should be installed at each spall location, and then the spalls should be patched with an appropriate material. The presence of a cast-in-place concrete deck on this bridge is helpful in distributing loads and makes this a much more robust structure. If cathodic protection is added to this bridge and the progression of the corrosion is slowed down, the service life of the bridge could be extended significantly.

Safety:

Overall safety at this bridge is good. Paved 2-lane section with 2-foot shoulders at crossing. Visibility approaching the bridge is good from both directions. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing. Loose gravel on the outer 2-feet of the shoulders, under the guardrail is encouraging the growth of tall prairie grasses. There are also trees on both sides of the roadway growing over the guardrail on onto the shoulders. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 4430 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

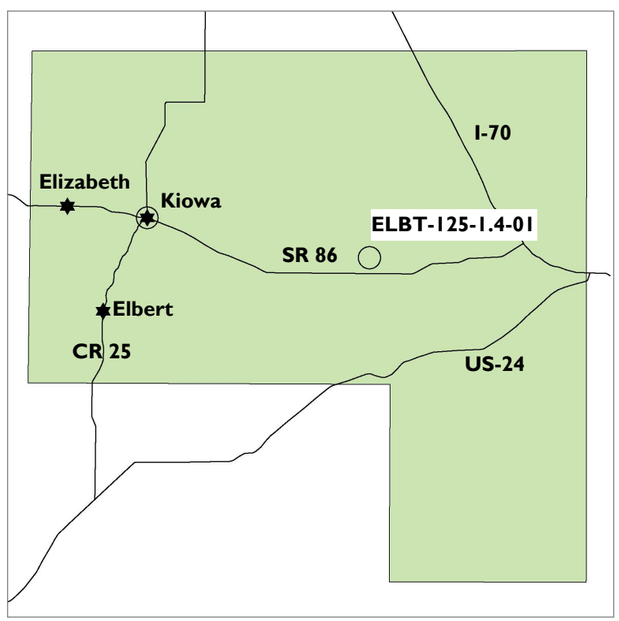
ELBT-125-1.4-01

CR 125 over East Bijou Creek

Existing Structure Data

Age:	54 years (built 1964)
Structure Length:	200'
Width Out to Out:	16.1' (C/C 14.4')
No. of Lanes on Bridge:	1
Average Daily Traffic:	33
Truck Traffic:	0%
Sufficiency Rating:	70.9
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	5

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,200
3	Replace failing repairs to spalled girder stems	$1,500
8	Clean and spot paint piles	$4,900
16	Replace bridge	$891,000

Recommended Replacement Strategy

- Replacement Priority: 2
- Estimated Remaining Life: 10 years (if no repairs are made)
- # of spans and total length: 3-span 200' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX24x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $891,000

Photos of Existing Condition

The repairs made to the bottoms of the stems of the girders are failing in most places. The repairs are cracking and bulging.

Typical corrosion at the bottoms of the piles at Piers 4 and 5.

Typical longitudinal cracking with efflorescence in bottom of stems of girders.

Most of the railing posts are upright, although all show rust at their bases. This post, at the southeast corner of the bridge, has been knocked off the curb and the object marker sign has been knocked down.

Evaluations by Discipline

Structural:

The structure carries CR 125 over East Bijou Creek. The deck and superstructure have "Satisfactory" condition ratings while the substructure has a "Fair" condition rating.

The current average daily traffic is 33 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

Hairline longitudinal cracks have developed in the base of the girder stem at most of the girders, indicating incipient spalling at the base of the stems. These cracks should be monitored; if unsound concrete is discovered during an inspection, it should be removed and repaired with cathodic protection. Other locations of spalling have been repaired previously, but the repairs are cracking and failing. These older repairs should be removed replaced, and cathodic protection should be added to prevent recurring failure of the repairs. The piles at Abutment 6 and Piers 4 and 5 are also in poor condition. The piles at Abutment 6 are no longer visible, but the piles at Piers 4 and 5 have heavy rust and should be cleaned and repainted.

The existing structure is adequate to carry this minor collector and its light traffic demands. Replacement of this structure with a culvert or a low water crossing would not be feasible for this long of a crossing and the high 100-year storm flows. A replacement bridge will be very expensive for this 200' crossing, but if the girders are repaired and maintained, then this bridge could continue its current level of service for an extended period of time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is adequte from both directions due to horizontal and vertical curves. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail. Appropriate signage due a one lane bridge installed on both approaches. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 12200 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-69-3.50-01

CR 69 over West Bijou Creek Tributary

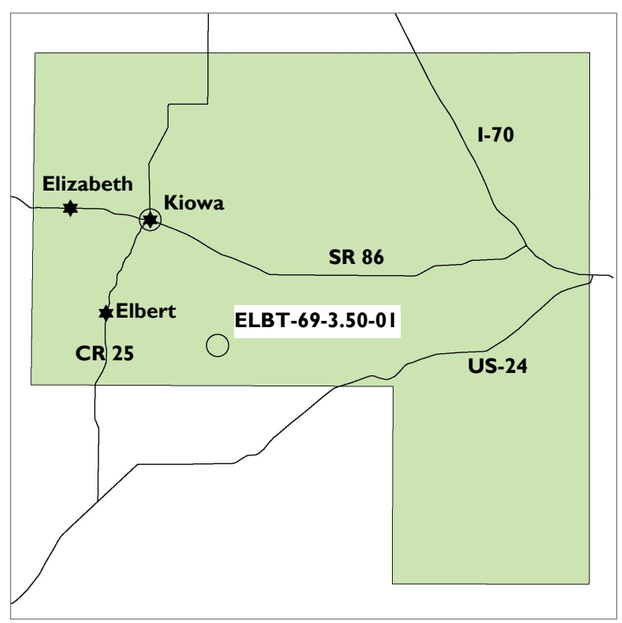
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,000
3	Patch spalled concrete with exposed PS strand in bottom of stem of Girder 1F and spalls with exposed rebar in Girders 1D, 2B, 4A, and 4C	$7,500
8	Repair spalled concrete cap at west end of Pier 2 and east end of Pier 3	$3,000
14	Patch spalls in girder top flanges adjacent to longitudinal joints	$12,000
16	Clean and spot paint piles	$2,800

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	160'
Width Out to Out:	16.1' (C/C 14.4')
No. of Lanes on Bridge:	1
Average Daily Traffic:	65
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 3
- Estimated Remaining Life: 10 years (if no repairs are made)
- Suggested Replacement Structure: Culvert
- Size: (4) - 84" CMP pipes
- Railing: Standard guardrail
- Travelway details: Travelway consists of one 13'-0" lane in each direction
- Estimated cost: $246,000

Photos of Existing Condition

A spall has occurred at the bottom of the stem of Girder 1F near midspan. A prestressing strand is exposed, which is corroded appears to have lost tension.

Spall with exposed reinforcing in west end of Pier 2 pile cap.

Most rail posts are damaged and bent; some are completely broken and detached from the curb.

R1 rust at the bottoms of the steel piles at Pier 2 and Pier 3.

Evaluations by Discipline

Structural:

The structure carries CR 69 over West Bijou Creek Tributary. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The current average daily traffic is 65 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

A spall has occurred in the stem of Girder 1F near midspan with exposed and corroded prestressing steel, and the inspection report notes hairline cracking at various locations in the stems of several girders. These double tees are reinforced with only a single line of prestressing strands in each stem, and loss of a strand would greatly reduce their carrying capacity. The existing structure is adequate to carry this rural local road and its light traffic demands.

Safety:

Overall safety at this bridge crossing is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope tying into one lane bridge. Visibility approaching the bridge is good from the west. It is poor from the east due to a steep vertical curve. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage due a one lane bridge. The westbound approach should have a steep slope sign as well as a one lane bridge ahead sign. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 1250 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

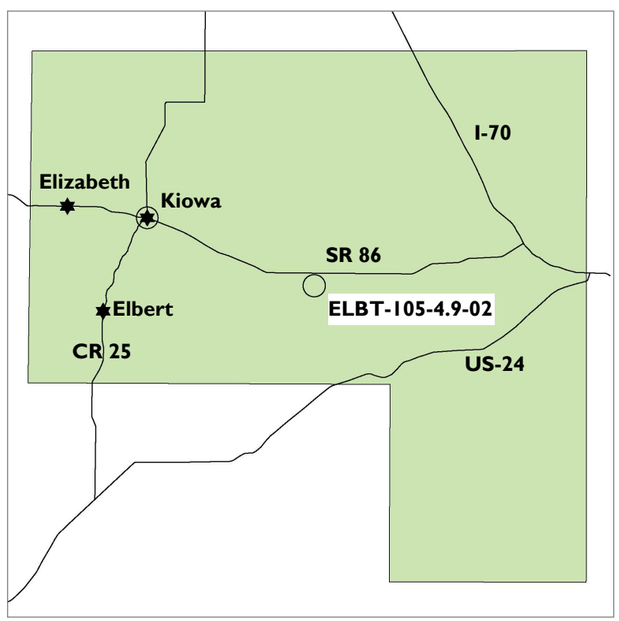
ELBT-105-4.9-02

CR 105 over East Bijou Creek

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	219.8'
Width Out to Out:	16' (C/C 14.5')
No. of Lanes on Bridge:	1
Average Daily Traffic:	95
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,400
1	Patch spall with exposed PS strand in Girder 3F stem	$1,500
6	Patch spall at bearing of Girder 3A stem	$9,000
16	Clean and spot paint piles	$8,800

Recommended Replacement Strategy

- Replacement Priority: 4
- Estimated Remaining Life: 10 years (if no repairs are made)
- Replacement Structure: Low water crossing
- Estimated cost: $189,000

Bridge Replacement Alternative

- # of spans and total length: 3-span 220' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX35x48), 20'-8" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of a single lane of traffic, 17'-8" wide
- Estimated cost: $922,000

Photos of Existing Condition

Spall with exposed prestressing strand at midspan of Girder 3F.

7 inch impending spall in Girder 3A at Pier 4.

Heavy R3 corrosion in bottom of piles at Pier 2.

The majority of the rail posts are missing on this bridge.

Evaluations by Discipline

Structural:

The structure carries CR 105 over East Bijou Creek. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The current average daily traffic is 95 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

A section of concrete has delaminated in the base of the stem of Girder 3A near Pier 4. The unsound concrete should be removed, and the spall should be repaired with cathodic protection. Hairline longitudinal cracks were also noted for the full length of Girders D, E and F in Span 2. These cracks should be monitored; if unsound concrete is discovered during an inspection, it should be removed and repaired with cathodic protection.

The existing structure is adequate to carry this rural local road and its light traffic demands. The recommended replacement option is a low water crossing, but pursuing this option will still incur a significant cost for removal of the existing structure. The most cost efficient approach to maintaining this water crossing is to repair the critical items on the existing structure and use it for as long as possible.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is adequate from both directions due to heavy tree overgrowth. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage due a one lane bridge. Trees should be trimmed to increase visibility. There are signs of erosion on the approaches. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 7190 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

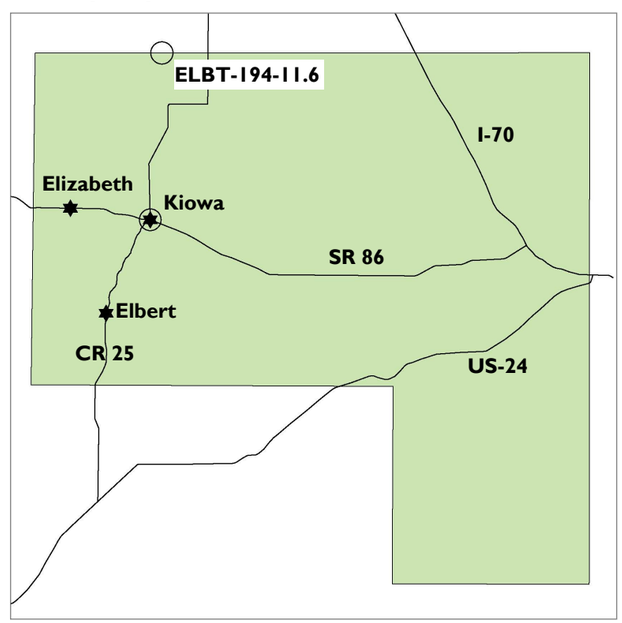
ELBT-194-11.6

CR 194 over Kiowa Creek

Existing Structure Data

Age:	54 years (built 1964)
Structure Length:	150'
Width Out to Out:	30' (C/C 36.9')
No. of Lanes on Bridge:	2
Average Daily Traffic:	242
Truck Traffic:	1%
Sufficiency Rating:	89.6
Deck Rating:	6
Superstructure Rating:	7
Substructure Rating:	6

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
6	Repair spalling in the top flange of the girders.	$45,000
16	Replace bridge	$858,000

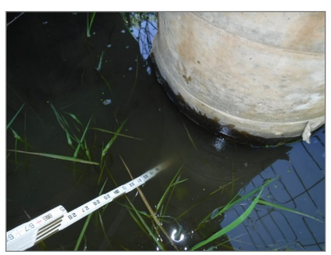
Recommended Replacement Strategy

- Replacement Priority: 5
- Estimated Remaining Life: 10 years (if no repairs are made)
- # of spans and total length: 2-span 150' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX35x48), 29'-11" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 12'-0" lane in each direction with 1'-5.5" shoulders on each side
- Estimated cost: $858,000

Photos of Existing Condition

9 foot long spall with both mats of reinforcing exposed in the top flange. This occurs in several locations adjacent to the longitudinal joint.

3 foot spall with exposed reinforcing in the bottom of the exterior top flange, Girder I, Span 5.



The soil underneath the concrete pile collars has been undermined in some locations, exposing more of the pile at the mudline.

Evaluations by Discipline

Structural:

The structure carries CR 194 over Kiowa Creek. The deck, superstructure and substructure all have "Good" or "Satisfactory" condition ratings.

The current average daily traffic is 242 vehicles with 1% trucks. This is the only 1960's era double tee bridge in the county which carries commercial truck traffic and the traffic demands here are higher than for other double tees.

The girders have heavy deterioration of their top flanges near the longitudinal joints with both layers of reinforcing steel exposed and corroded. It appears that these areas were previously repaired, but the repair concrete is spalling off in many locations. Because this bridge carries truck traffic, deterioration is likely to progress faster than on the other double tee bridges. Cathodic protection should be installed on the exposed reinforcing and an appropriate repair material should be used to patch the spalls.

The existing structure may not be adequate to carry this major collector. The load rating indicates that the girder have reserve capacity for typical truck loads, but this load rating was performed in 1995 and has not been verified since. No plans are available, and the area of prestressing steel as well as the steel properties are unknown. It is also unknown if the load rating counted on lateral distribution of loads between the tees through the longitudinal joint keys which are now broken. This bridge will need to be replaced with a more modern structure at some point in the future, but the current girder should be maintained and kept in place for as long as possible.

Safety:

Overall safety at this bridge is good. Paved 2-lane section with 2 to 4-foot clear zones in front of the guardrail at crossing. Visibility approaching the bridge is adequate from both directions. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing.

Trees and vegetation on both sides of the bridge will soon be compromising visibility. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 7930 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-182-0.7-01

CR 182 over West Bijou Creek Tributary

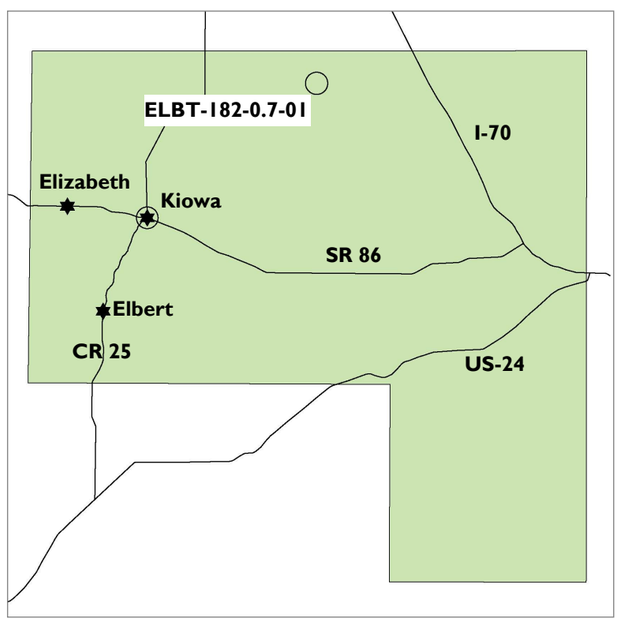
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$200
4	Add riprap to erosion troughs behind wingwalls to arrest erosion	$2,400
8	Clean and paint piles	$16,000

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	40.3'
Width Out to Out:	15' (C/C 15')
No. of Lanes on Bridge:	1
Average Daily Traffic:	17
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	7
Superstructure Rating:	7
Substructure Rating:	6

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 6
- Estimated Remaining Life: 10 years (if no repairs are made)
- Suggested Replacement Structure: Culvert
- Size: (5) - 84" CMP pipes
- Railing: Standard guardrail
- Travelway details: Travelway consists of one 12'-0" lane in each direction
- Estimated cost: $308,000

Photos of Existing Condition

Deep erosion troughs at the corners of each wingwall reaching back towards roadway.

Typical R1 corrosion, full height of steel piles. Damaged pile at northeast wingwall.

W-beam guardrail has been laid flat along both sides of bridge. Guardrail is not oriented to be able to deflect an errant vehicle back onto the road.

Evaluations by Discipline

Structural:

The structure carries CR 182 over West Bijou Creek Tributary. The deck, superstructure and substructure all have "Good" or "Satisfactory" condition ratings.

The current average daily traffic is 17 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

The piles at each abutment are showing signs of deterioration, with light to moderate rust over their entire height. These piles should be cleaned and repainted. Additionally, deep erosion troughs have formed at each corner of the bridge behind the wingwalls which will extend into the roadway if the erosion is not mitigated.

The existing structure is adequate to carry this rural local road and its light traffic demands. If the piles are protected against further corrosion and the girders are maintained, then this bridge could continue its current level of service for an extended period of time.

Safety:

Overall safety at this bridge is very poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is good from both directions. There is no bridge railing on one side of the bridge and its hanging off the other. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Major roadway and abutment erosion on both approaches. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 1530 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

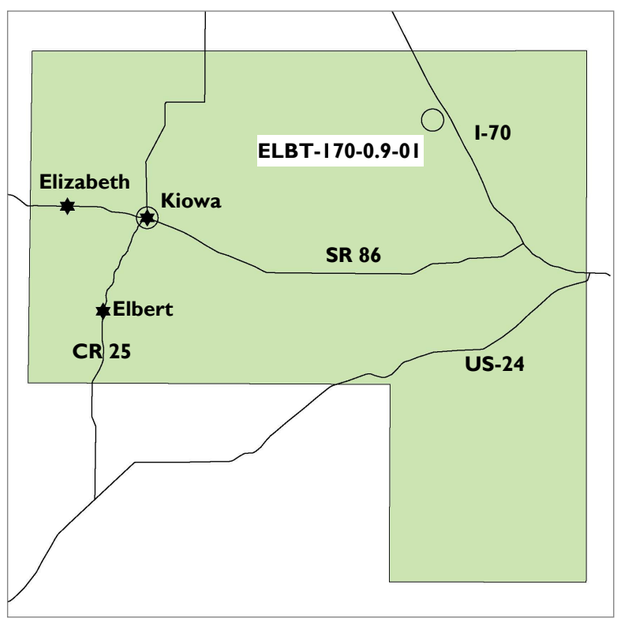
ELBT-170-0.9-01

CR 170 over East Bijou Creek

Existing Structure Data

Age:	99 years (built 1919)
Structure Length:	71'
Width Out to Out:	19.9' (C/C 19.6')
No. of Lanes on Bridge:	1
Average Daily Traffic:	19
Truck Traffic:	0%
Sufficiency Rating:	54.3
Deck Rating:	5
Superstructure Rating:	5
Substructure Rating:	4

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
2	Remove debris and excess vegetation from channel	$1,000
9	Install object markers at east end and reset markers at west	$400
10	Replace bridge with a RC box culvert	$225,000

Recommended Replacement Strategy

- Replacement Priority: 7
- Estimated Remaining Life: 5 years (if no repairs are made)
- Suggested Replacement Structure: Culvert
- Size: 4-cell 12'x8' concrete box culvert
- Railing: Bridge rail Type 10
- Travelway details: Travelway consists of one 12'-0" lane in each direction
- Estimated cost: $225,000

Photos of Existing Condition

Typical view of corrosion and pitting on steel girders.

Corrosion of piles near waterline at Abutment 1.

South end at Pier 2 is twisted. Typical buildup of debris against bridge is also shown here.

Typical corrosion and leakage staining in deck soffit.

Evaluations by Discipline

Structural:

The structure carries CR 170 over East Bijou Creek. The deck has a "Fair" condition rating, but the superstructure and substructure each have "Poor" condition ratings, indicating advanced section loss.

CR 170 is a dead end road with a current average daily traffic of 19 vehicles with no trucks. There are two households on the west side of the bridge as well as access to farm fields to the south and west.

The current structure is nearly a century old. All of the steel beams in the superstructure are covered in rust with measurable corrosion in the top flange near the deck joints, but the load rating results shown in the inspection report indicate that the superstructure has ample capacity for its typical traffic demands. However, the load rating does not include the substructure, which may be in much worse shape. The inspection report identifies severe corrosion to all of the steel piles, but the water level was too high at the time of the last several inspections to measure the remaining section or to document the losses with photographs. It is unknown how much section is remaining in the piles and what load carrying capacity they have.

Water pools under the bridge year round, making substructure inspection and repairs difficult. An inspection needs to be scheduled during a time of the year when the water is lowest to assess the extent of the pile corrosion. If enough section remains, the bridge could be kept in service for several years until a replacement structure can be designed and put in place. If the corrosion is very severe, an engineer should be contacted immediately to design emergency shoring or repairs to keep the bridge in service until it can be replaced. Both the upstream and downstream sides of the bridge are surrounded by significant wetlands.

Safety:

Overall safety at this bridge is very poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is adequate from both directions due to tree overgrowth. There is no bridge railing, delineators or any object markers approaching or on the bridge.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 29800 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

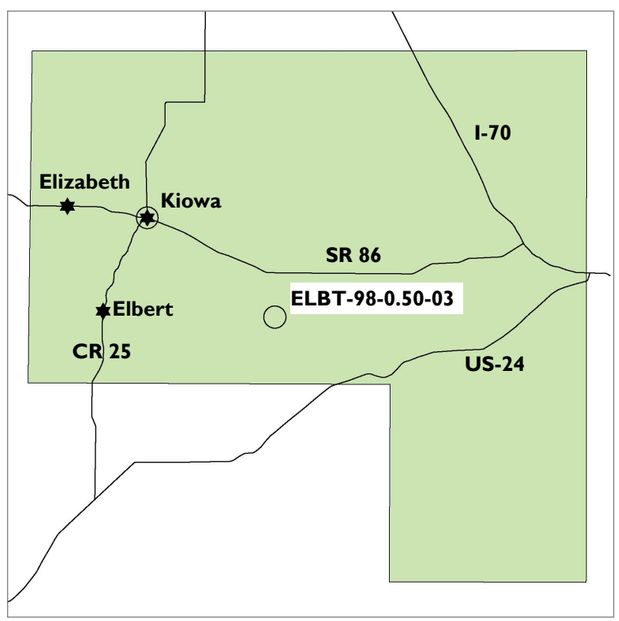
ELBT-98-0.50-03

CR 98 over East Bijou Creek

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	100'
Width Out to Out:	16.1' (C/C 14.5')
No. of Lanes on Bridge:	1
Average Daily Traffic:	21
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$600
2	Patch spall with exposed PS strand in Girder 2C stem	$1,500
8	Clean and spot paint piles	$2,800
10	Patch spalls in edge of exterior girder top flange	$15,000

Recommended Replacement Strategy

- Replacement Priority: 8
- Estimated Remaining Life: 15 years (if no repairs are made)
- Replacement Structure: Low water crossing
- Estimated cost: $108,000

Alternative Future Plan

- Plan for Bridge After Service Life is Over: Closure
- Justification: This structure has a very low average daily traffic (21 currently, 33 predicted for 2037). CR 98 is only a through route for trips originating in the vicinity of ELBT-98-0.50-03, and other traffic can easily circumvent the closure by taking CR77 (if headed west) or CR105 (if headed east).

Photos of Existing Condition

Most rail posts are damaged and bent, with heavy rust at their base.

8 inch long spall with exposed prestressing strand at the base of the stem in Girder 2C. The strand has not yet started to corrode.

Heavy R2 to R3 corrosion at the base of the piles at Pier 2.

6 foot long spall with exposed rebar in top exterior flange of Girder 1A.

Evaluations by Discipline

Structural:

The structure carries CR 98 over East Bijou Creek. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The current average daily traffic is 21 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

A spall has occurred in the stem of Girder 2C near midspan with exposed prestressing steel. These double tees are reinforced with only a single line of prestressing strands in each stem, and loss of a strand would greatly reduce their carrying capacity. The steel is not yet corroded, but a repair that includes cathodic protection should be done in the near future to protect the future integrity of the girder. Another item of concern is the level of corrosion of the steel piles at Pier 2. The 2015 inspection shows up to 50% section loss of the piles near the waterline. All piles should be cleaned and painted to prevent further loss of section.

The existing structure is adequate to carry this rural local road and its light traffic demands. The recommended replacement option is a low water crossing, but pursuing this option will still incur a significant cost for removal of the existing structure. The most cost efficient approach to maintaining this water crossing is to repair the critical items on the existing structure and use it for as long as possible.

Safety:

Overall safety at this bridge crossing is poor. Un-paved 1.5-lane approach sections with no clear zones adjacent to steep foreslope tying into one lane bridge. Visibility approaching the bridge is good from both directions. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge. Vegetation is growing high enough to obstruct several of the object marker signs.

Approaches are missing proper guardrail and appropriate signage due a one lane bridge. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 4110 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-162-0.5-01

CR 162 over Wilson Creek Tributary

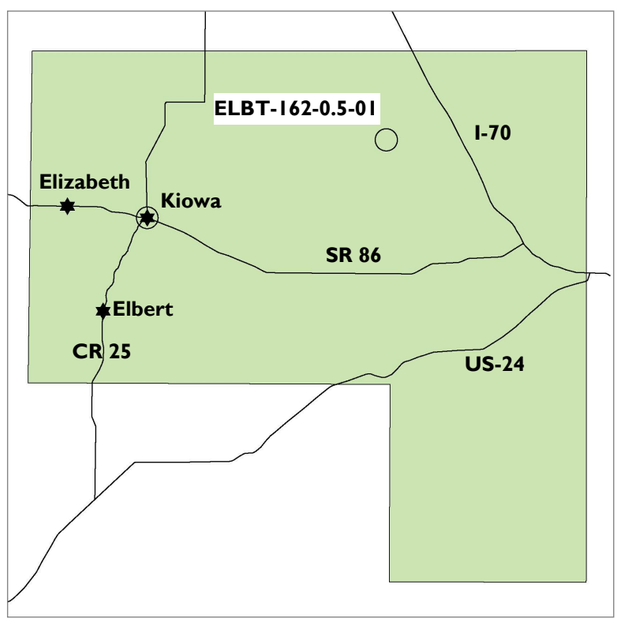
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$400
2	Clean and spot paint piles	$8,000
8	Fill scour hole under Pier 2	$7,000
8	Encase piles in concrete near water line	$2,000

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	60'
Width Out to Out:	16.1' (C/C 14.4')
No. of Lanes on Bridge:	1
Average Daily Traffic:	68
Truck Traffic:	0%
Sufficiency Rating:	70.9
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	5

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 9
- Estimated Remaining Life: 15 years (if no repairs are made)
- # of spans and total length: 1-span 60' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX24x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $434,000

Photos of Existing Condition

Pier piles have heavy corrosion around waterline.

Most railing posts are missing from south side. The north side is similar.

Evaluations by Discipline

Structural:

The structure carries CR 162 over Wilson Creek Tributary. The deck and superstructure have "Satisfactory" condition ratings while the substructure has a "Fair" condition rating.

The current average daily traffic is 68 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

The steel piles at the pier are in poor condition, and a scour hole is present under the pier. Standing water sits at Pier 2 year round, and the piles have been heavily corroded at the waterline. The area around the bridge is a wetland, and it may not be possible to fill in the hole and remove the standing water. However, the pier piles do need to be cleaned and repaired to prevent continued loss of section.

The existing structure is adequate to carry this minor collector and its light traffic demands. The girders have minor edge spalling, but are in good condition overall. The corrosion problems at the pier need to be addressed if this structure is intended to remain in service.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is adequate from both directions due to horizontal and vertical curves. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at two corners of the crossing.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone X floodplain.
- 100-year peak flood flow is 2390 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

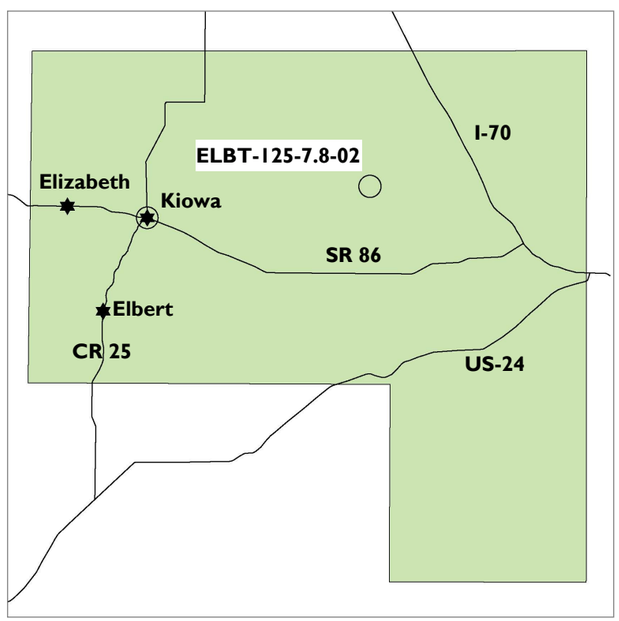
ELBT-125-7.8-02

CR 125 over Wilson Creek

Existing Structure Data

Age:	54 years (built 1964)
Structure Length:	180'
Width Out to Out:	16' (C/C 14.3')
No. of Lanes on Bridge:	1
Average Daily Traffic:	25
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,100
8	Clean and spot paint piles	$2,100

Recommended Replacement Strategy

- Replacement Priority: 10
- Estimated Remaining Life: 15 years (if no repairs are made)
- # of spans and total length: 2-span 180' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX44x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $943,000

Photos of Existing Condition

R2 corrosion at base of Pier 2 columns. Pier 3 has similar deterioration.

All railing posts are loose or broken. The east rail cable is missing.

Hairline crack with surface delamination at the bottom of the stem in Girder 1C.

Evaluations by Discipline

Structural:

The structure carries CR 125 over Wilson Creek. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The current average daily traffic is 25 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

Girder 1C has a hairline crack with some surface delamination at the base of the stem. This crack should be monitored; if unsound concrete is discovered during an inspection, it should be removed and repaired with cathodic protection. The piles at Piers 2 and 3 are also showing corrosion at their base; the corrosion should be cleaned and the piles repainted.

The existing structure is adequate to carry this minor collector and its light traffic demands. Typical minor spalling is occurring at the edges of the top flanges adjacent to the longitudinal joint, and this should be monitored in case the spalling starts to work inwards. If repairs to the top flange and stems are performed as needed, this bridge could continue its current level of service for an extended period of time.

Safety:

The overall required signage at this bridge location is in ok condition. Signs are still upright and visible, but existing delineators are old and no longer reflective. As the bridge only has cable guards, delineators should be added along the edges of the deck and at each end of the bridge as a caution to drivers .

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 6080 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

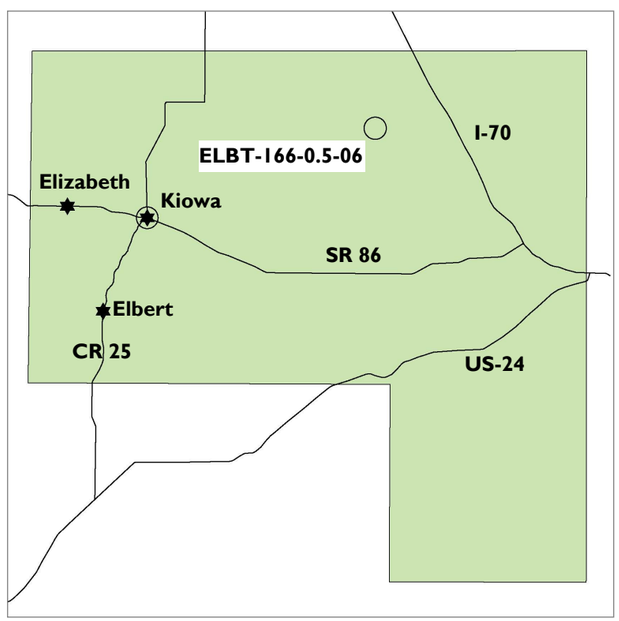
ELBT-166-0.5-06

CR 166 over Wilson Creek

Existing Structure Data

Age:	54 years (built 1964)
Structure Length:	160'
Width Out to Out:	16.1' (C/C 14.4')
No. of Lanes on Bridge:	1
Average Daily Traffic:	24
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,000
8	Clean and spot paint piles	$18,000

Recommended Replacement Strategy

- Replacement Priority: 10
- Estimated Remaining Life: 15 years (if no repairs are made)
- Replacement Structure: Low water crossing
- Estimated cost: $211,000

Bridge Replacement Alternative

- # of spans and total length: 2-span 160' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX35x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $765,000

Photos of Existing Condition

Typical R1 corrosion at base of pier piles and cross bracing.

Bent railing post. Most railing posts are corroded near their base.

Evaluations by Discipline

Structural:

The structure carries CR 166 over Wilson Creek. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The current average daily traffic is 24 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

The steel piles at Piers 3 and 4 have moderate corrosion at their base. The corrosion should be cleaned and the piles should be repainted.

The existing structure is adequate to carry this rural local road and its light traffic demands. The recommended replacement option is a low water crossing, but pursuing this option will still incur a significant cost for removal of the existing structure. The most cost efficient approach to maintaining this water crossing is to keep the existing structure in good condition. The traffic demand is very small, and as long as corrosion is halted and repaired whenever it is discovered, this bridge could remain in service for a long time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is good from both directions. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging over the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Roadway is showing signs of erosion on approaches and trees are beginning to overhang roadway. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 9410 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

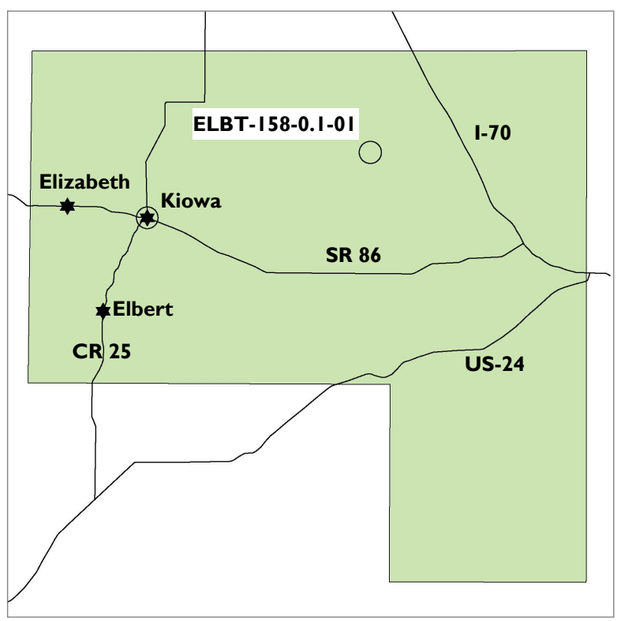
ELBT-158-0.1-01

CR 158 over Wilson Creek

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	180'
Width Out to Out:	16.1' (C/C 14.4')
No. of Lanes on Bridge:	1
Average Daily Traffic:	22
Truck Traffic:	0%
Sufficiency Rating:	70.9
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	5

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,100
8	Clean and spot paint piles	$5,600

Recommended Replacement Strategy

- Replacement Priority: 12
- Estimated Remaining Life: 15 years (if no repairs are made)
- # of spans and total length: 2-span 180' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX44x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $939,000

Photos of Existing Condition

Typical corrosion at base of pier piles.

Most railing posts are damaged and bent; some are completely broken and detached from the curb.

Evaluations by Discipline

Structural:

The structure carries CR 158 over Wilson Creek. The deck and superstructure have "Satisfactory" condition ratings while the substructure has a "Fair" condition rating.

The current average daily traffic is 22 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

The steel piles at Piers 3 and 4 have moderate corrosion at their base. The corrosion should be cleaned and the piles should be repainted.

The existing structure is adequate to carry this minor collector and its light traffic demands. The girders have minor edge spalling, but are in good condition overall. If the piles are protected against further corrosion and the girders are maintained, then this bridge could continue its current level of service for an extended period of time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is good from both directions. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent. There are proper object markers at two of the four corners of the crossing.

Approaches are missing proper guardrail. Appropriate signage due a one lane bridge installed on both approaches. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 8620 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

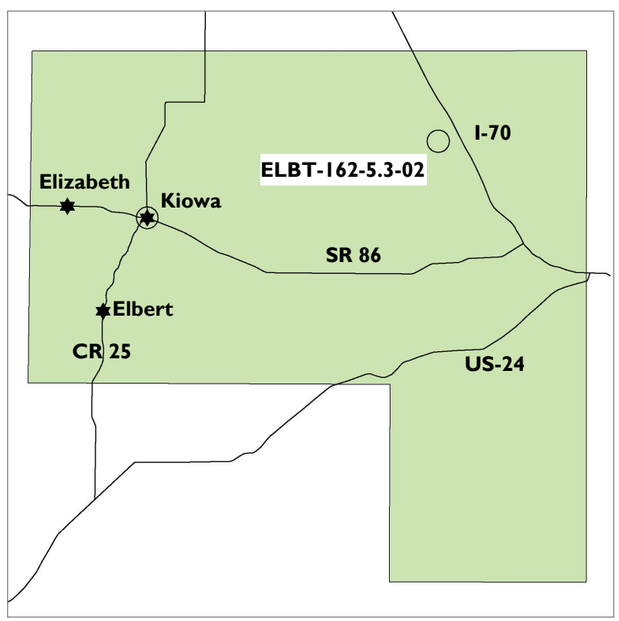
ELBT-162-5.3-02

CR 162 over East Bijou Creek

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	140'
Width Out to Out:	16' (C/C 14.3')
No. of Lanes on Bridge:	1
Average Daily Traffic:	76
Truck Traffic:	0%
Sufficiency Rating:	71
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	5

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Replace object markers at east end	$200
1	Install delineators along both edges of deck, full length of bridge	$850
8	Clean and spot paint piles	$1,400
28	Fill scour hole under Pier 3	$3,000

Recommended Replacement Strategy

- Replacement Priority: 12
- Estimated Remaining Life: 15 years (if no repairs are made)
- # of spans and total length: 2-span 140' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX35x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $692,000

Photos of Existing Condition

R2 corrosion on bottom of Pier 3 and localized scour.

The cable railing and posts are missing from the south edge; north similar.

Evaluations by Discipline

Structural:

The structure carries CR 162 over East Bijou Creek. The deck and superstructure have "Satisfactory" condition ratings while the substructure has a "Fair" condition rating.

The current average daily traffic is 76 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

The steel piles at Pier 3 have moderate corrosion at their base. The corrosion should be cleaned and the piles should be repainted.

The existing structure is adequate to carry this minor collector and its light traffic demands. The girders have minor edge spalling, but are in good condition overall. If the piles are protected against further corrosion and the girders are maintained, then this bridge could continue its current level of service for an extended period of time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is good from both directions. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent or have fallen off and the metal cable is hanging over the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Roadway is showing signs of erosion on approaches and trees are beginning to overhang. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 24000 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-178-3.6-01

CR 178 over Bijou Creek Tributary

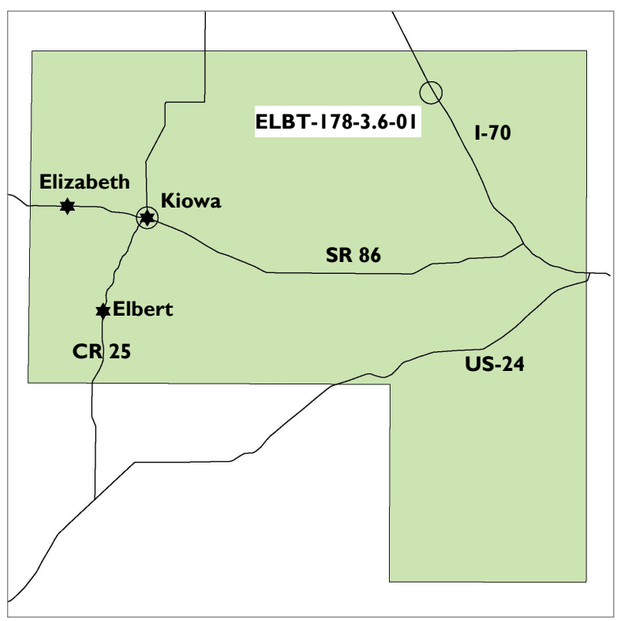
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$500
8	Clean and paint steel piles	$9,000
8	Fill scour hole under Pier 2	$7,000
12	Repair pending spalls at bottom of stems of girders	$6,000

Existing Structure Data

Age:	54 years (built 1964)
Structure Length:	80'
Width Out to Out:	16.1' (C/C 14.5')
No. of Lanes on Bridge:	1
Average Daily Traffic:	32
Truck Traffic:	0%
Sufficiency Rating:	71
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	5

Vicinity Map

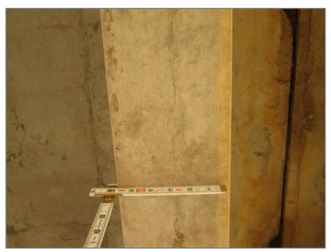


Recommended Replacement Strategy

- Replacement Priority: 12
- Estimated Remaining Life: 15 years (if no repairs are made)
- Suggested Replacement Structure: Culvert
- Size: (5) - 132" CMP pipes
- Railing: Standard guardrail
- Travelway details: Travelway consists of one 12'-0" lane in each direction
- Estimated cost: $348,000

Photos of Existing Condition

Typical corrosion on pier piles near waterline.



Typical longitudinal cracking on bottom of girder stems.

Cable rail is loose on both sides of bridge; railing posts are heavily rusted.

Evaluations by Discipline

Structural:

The structure carries CR 178 over Bijou Creek Tributary. The deck and superstructure have "Satisfactory" condition ratings while the substructure has a "Fair" condition rating.

The current average daily traffic is 32 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

Hairline longitudinal cracks have developed in the base of the girder stem on two-thirds of the girders, indicating incipient spalling at the base of the stems. These cracks should be monitored; if unsound concrete is discovered during an inspection, it should be removed and repaired with cathodic protection. The piles at the pier are also showing signs of deterioration, with moderate rust near the waterline. These piles should be cleaned and repainted.

The existing structure is adequate to carry this rural local road and its light traffic demands. If the deterioration in the girders and piles is prevented from worsening, then this bridge could continue its current level of service for an extended period of time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is good from both directions. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging over the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 2980 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

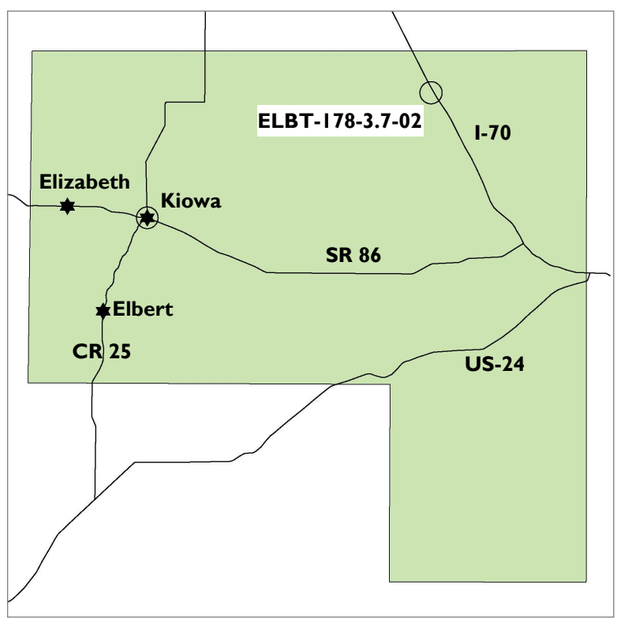
ELBT-178-3.7-02

CR 178 over Bijou Creek

Existing Structure Data

Age:	54 years (built 1964)
Structure Length:	70’
Width Out to Out:	16.1’ (C/C 14.5’)
No. of Lanes on Bridge:	1
Average Daily Traffic:	32
Truck Traffic:	0%
Sufficiency Rating:	71
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	5

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$500
8	Clean and spot paint steel piles	$4,900

Recommended Replacement Strategy

- Replacement Priority: 12
- Estimated Remaining Life: 15 years (if no repairs are made)
- # of spans and total length: 1-span 100' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX44x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $654,000

Photos of Existing Condition

Most railing posts are bent and the cable rails are slack.

Typical R1 corrosion at base of pier piles.

Evaluations by Discipline

Structural:

The structure carries CR 178 over Bijou Creek. The deck and superstructure have "Satisfactory" condition ratings while the substructure has a "Fair" condition rating.

The current average daily traffic is 32 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

The piles at the pier are showing signs of deterioration, with moderate rust near their base. These piles should be cleaned and repainted.

The existing structure is adequate to carry this rural local road and its light traffic demands. The girders have minor edge spalling, but are in good condition overall. If the piles are protected against further corrosion and the girders are maintained, then this bridge could continue its current level of service for an extended period of time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is good from both directions. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging over the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Some erosion on approaches. Trees starting to encroach into area of bridge and will shortly be impeading sight distance from both directions. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 32300 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-190-0.3-01

CR 190 over Wilson Creek

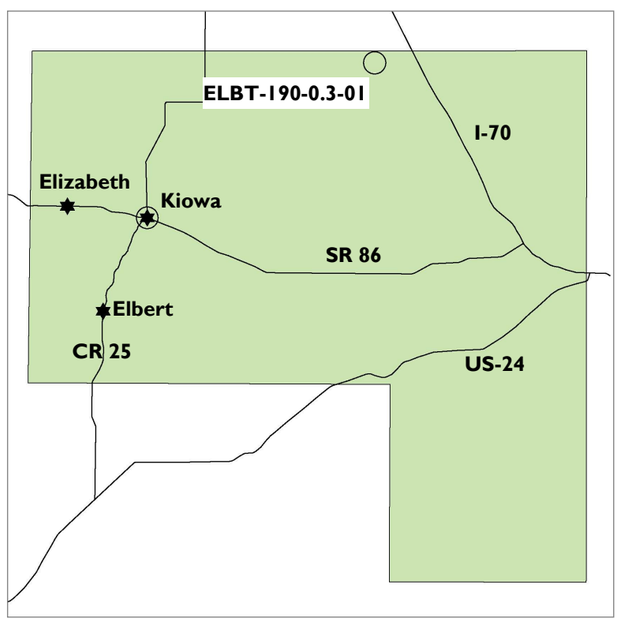
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install 1-Lane bridge sign at west approach	$200
1	Reset object markers at approaches	$200
1	Install delineators along both edges of deck, full length of bridge	$1,500
8	Clean and spot paint piles	$5,600
28	Repair spalls with exposed rebar in bottom of top flange	$36,000

Existing Structure Data

Age:	54 years (built 1964)
Structure Length:	240'
Width Out to Out:	16' (C/C 14.4')
No. of Lanes on Bridge:	1
Average Daily Traffic:	22
Truck Traffic:	0%
Sufficiency Rating:	70
Deck Rating:	5
Superstructure Rating:	5
Substructure Rating:	6

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 16
- Estimated Remaining Life: 15 years (if no repairs are made)
- Replacement Structure: Low water crossing
- Estimated cost: $109,000

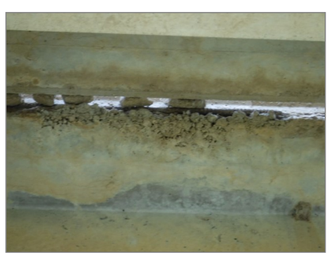
Bridge Replacement Alternative

- # of spans and total length: 3-span 240' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX35x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $1,092,000

Photos of Existing Condition

Typical R1 to R2 corrosion at base of pier piles.

South railing missing for half the length of the bridge. The north railing is missing for the full length of the bridge.



Typical spall with exposed rebar in bottom of top flanges.

Evaluations by Discipline

Structural:

The structure carries CR 190 over Wilson Creek. The deck has a "Satisfactory" condition rating while the superstructure and substructure have a "Fair" condition rating.

The current average daily traffic is 22 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

The piles at all piers and at Abutment 7 are showing signs of deterioration, with moderate rust near their base. These piles should be cleaned and repainted.

The existing structure is adequate to carry this rural local road and its light traffic demands. The recommended replacement option is a low water crossing, but pursuing this option will still incur a significant cost for removal of the existing structure. The most cost efficient approach to maintaining this water crossing is to keep the existing structure in good condition. The traffic demand is very small, and as long as corrosion is halted and repaired whenever it is discovered, this bridge could remain in service for a long time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is adequate from both directions due to horizontal and vertical curves and some tree overgrowth. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at two corners of the crossing.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Erosion beginning on both approaches and abutments. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 12100 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

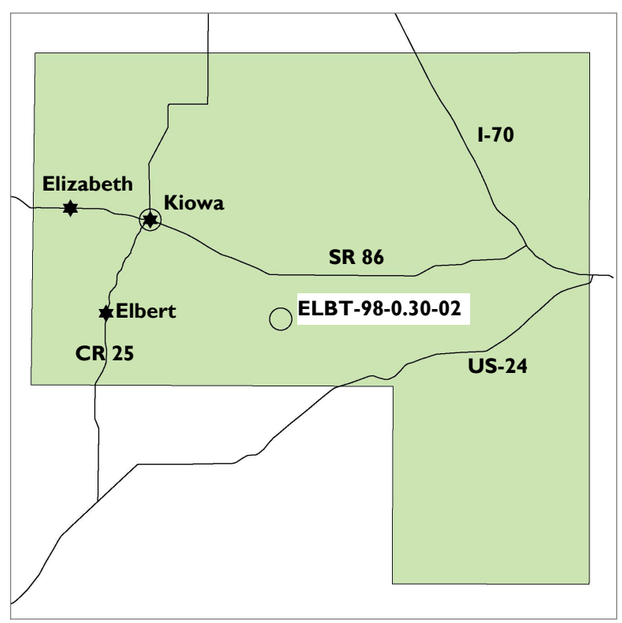
ELBT-98-0.30-02

CR 98 over Kiowa Creek

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	180'
Width Out to Out:	16.1' (C/C 14.5')
No. of Lanes on Bridge:	1
Average Daily Traffic:	51
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	5

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,100
8	Clean and spot paint piles	$2,800

Recommended Replacement Strategy

- Replacement Priority: 17
- Plan for Bridge After Service Life is Over: Closure
- Justification: This structure has a low average daily traffic and is not on the shortest route for any through traffic. The detour length for this bridge is only 2 miles, and removing this crossing would not have a large negative impact to the local community. The channel of West Bijou Creek is deep, and the condition of the existing Pier 4 indicates problems with scour and channel degradation in the past. This site is not recommended for a low water crossing.

Photos of Existing Condition

View of Pier 4 pile in 2015 prior to channel improvement. The channel had degraded 6 feet, and at least 3 feet of the piles had R2 rust.

Pier 4 after scour repair was performed. It appears that the piles were repainted at the time of the repair.

Water may be ponding near the groundline, and R2 rust is still present at the base of the piles.

Rail posts are damaged and bent; some are completely broken and detached from the curb.

Evaluations by Discipline

Structural:

The structure carries CR 98 over Kiowa Creek. The deck and superstructure have "Satisfactory" condition ratings while the substructure has a "Fair" condition rating.

The current average daily traffic is 21 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration.

The main item of concern for this bridge is the condition of the piers. The 2015 inspection report shows that the channel degraded 6 feet below the paint line on Pier 4 piles, and the substructure rating was reduced to 4 due to scour. Rehabilitation was performed between the 2015 and 2017 inspections which included filling in the deepest section of channel degradation and adding riprap to prevent future scour. However, based on the channel profile measurements taken during the inspections, the elevation at Pier 4 was only raised 0.7 feet, which might be the thickness of the riprap layer. It does not appear that any work was performed to improve the stability of the exposed Pier 4 piles, and without plans and pile tip elevations the capacity of the elongated unbraced pile length cannot be determined.

The operating rating load for this bridge is reported as 40 tons in the Structure Inspection and Inventory Report. However, as-built plans are unavailable for this bridge, and this load rating is based on field evaluation and engineering judgment. The load rating also only considers the superstructure, and does not account for the additional 6 feet of exposed pile at Pier 4. Stantec recommends that the bridge be posted for light truck and passenger vehicles only or closed at this time.

Safety:

Overall safety at this bridge crossing is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope tying into one lane bridge. Visibility approaching the bridge is good from the west. It is poor from the east due to a steep vertical curve. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage due a one lane bridge. The westbound approach should have a steep slope sign as well as a one lane bridge ahead sign. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 2020 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-162-3.9-01

CR 162 over Kiowa Creek

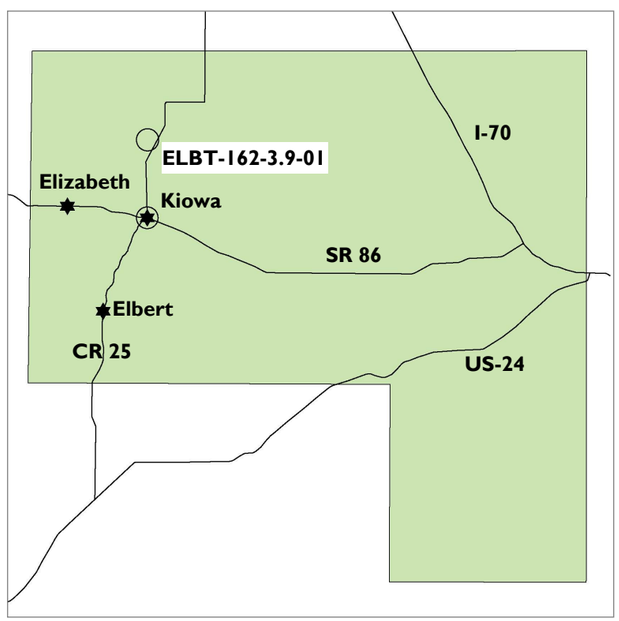
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,200
8	Clean and spot paint piles	$10,500
18	Fill erosion holes behind wingwalls	$800

Existing Structure Data

Age:	52 years (built 1966)
Structure Length:	201'
Width Out to Out:	16.1' (C/C 14.4')
No. of Lanes on Bridge:	1
Average Daily Traffic:	143
Truck Traffic:	0%
Sufficiency Rating:	77.9
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 18
- Estimated Remaining Life: 15 years (if no repairs are made)
- # of spans and total length: 3-span 201' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX35x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $951,000

Photos of Existing Condition

Typical R1 corrosion on pier piles.

All railing posts are rusted at their bases. Some posts are missing or damaged.

Erosion holes are present behind wingwalls.

Evaluations by Discipline

Structural:

The structure carries CR 162 over Kiowa Creek. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The current average daily traffic is 143 vehicles with no trucks. This current traffic volume is relatively low, and without the impact of truck traffic the daily usage of the bridge will likely be a minor contributor to structural deterioration. However, this bridge is in a region of moderate development pressure, and the usage of the road may change within the bridge's lifetime.

The steel piles at Piers 3 and 4 have moderate corrosion at their base. The corrosion should be cleaned and the piles should be repainted.

The existing structure is adequate to carry this rural local road and its light traffic demands. The girders have minor edge spalling, but are in good condition overall. If the piles are protected against further corrosion and the girders are maintained, then this bridge could continue its current level of service for an extended period of time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is good from both directions. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. Roadway is showing signs of erosion on approaches. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 6020 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

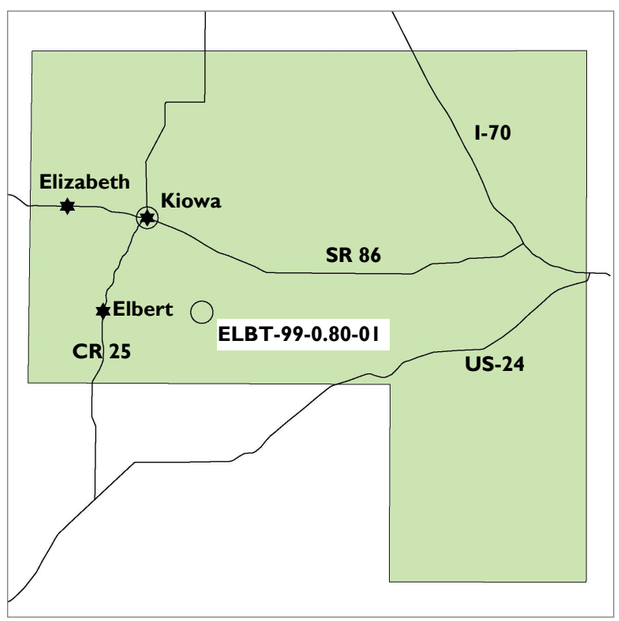
ELBT-99-0.80-01

CR 99 over West Bijou Creek Tributary

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	180'
Width Out to Out:	16.2' (C/C 14.5')
No. of Lanes on Bridge:	1
Average Daily Traffic:	71
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,100
4	Drill holes in H-section lateral bracing so that water does not pool against piles	$200
8	Clean and repaint piles at abutments	$1,500
16	Clean and paint all steel piles	$30,000
20	Repair erosion trough in front of Abutment 1	$800
24	Repair open joint above Abutment 1	$400

Recommended Replacement Strategy

- Replacement Priority: 19
- Estimated Remaining Life: 15 years (if no repairs are made)
- Replacement Structure: Low water crossing
- Estimated cost: $192,000

Bridge Replacement Alternative

- # of spans and total length: 2-span 180' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX44x48), 24'-10" out to out, 45° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $972,000

Photos of Existing Condition

Rail posts are damaged and bent; some are completely broken and detached from the curb.

Water is pooling in the H-section lateral bracing. Holes need to be drilled in the web of the bracing to allow the water to drain out.

R2 corrosion at Abutment 1 steel piles.

Evaluations by Discipline

Structural:

The structure carries CR 99 over West Bijou Creek Tributary. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The H-section lateral bracing welded to the pier piles collects water and may cause corrosion at the intersections with the piles. Holes should be drilled into the lateral member to allow the water to drain, although no significant corrosion has occurred here yet. The abutment piles do have significant corrosion due to leakage from the open joints above the abutments. These piles should be cleaned and repainted.

The existing structure is adequate to carry this minor collector and its light traffic demands. The girders have minor edge spalling, but are in good condition overall. If repairs are made, the life of this bridge could be significantly extended.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope tying into one lane bridge. Visibility approaching the bridge is adequate from both directions due to horizontal curves. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging off the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge. Marker signs are all bent or shot up in need of repair or replacement.

Approaches are missing proper guardrail and appropriate signage due a one lane bridge. The westbound approach should have a steep slope sign as well as a one lane bridge ahead sign. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 4740 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-182-4.1-02

CR 182 over Bijou Creek Tributary

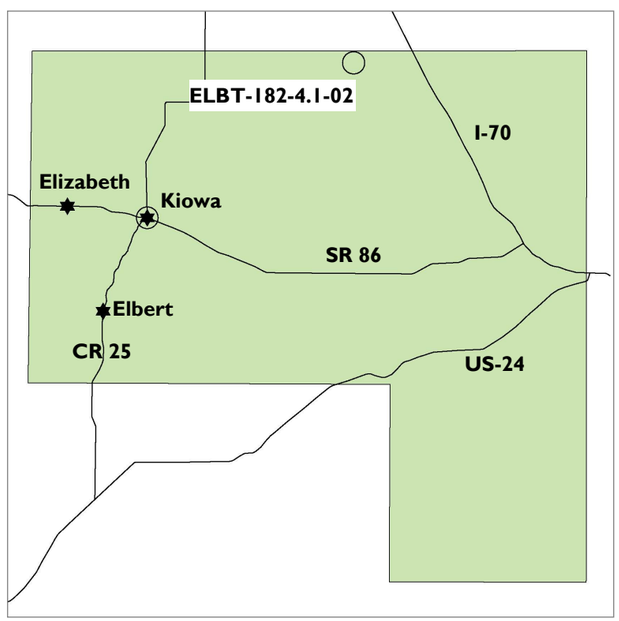
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$200
8	Patch base of A1 and A2 to prevent loss of fill at base of abutment	$2,000
8	Clean and spot paint piles	$12,000

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	40'
Width Out to Out:	16.2' (C/C 14.6')
No. of Lanes on Bridge:	1
Average Daily Traffic:	23
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 20
- Estimated Remaining Life: 15 years (if no repairs are made)
- # of spans and total length: 1-span 40' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX44x48), 24'-10" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 10'-11" lane in each direction
- Estimated cost: $347,000

Photos of Existing Condition

Abutment 1 is undermined.

Corrosion of abutment piles.

Most railing posts are bent or broken off of curb. The cable railing is slack.

Evaluations by Discipline

Structural:

The structure carries CR 182 over Bijou Creek Tributary. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The current average daily traffic is 23 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

The piles at both abutments have light to moderate rust over half their height, with heavier rust near the base. These piles should be cleaned and repainted. The precast abutment walls do not go all the way to the groundline, and some undermining is occurring at Abutment 1 that should be filled in and patched.

The existing structure is adequate to carry this rural local road and its light traffic demands. The recommended replacement option is a low water crossing, but pursuing this option will still incur a significant cost for removal of the existing structure. The most cost efficient approach to maintaining this water crossing is to keep the existing structure in good condition. The traffic demand is very small, and as long as corrosion is halted and repaired whenever it is discovered, this bridge could remain in service for a long time.

Safety:

The required signage at this bridge location is in very poor condition. Some signs are still reflective and useful, but 6 of them are worn and no longer salvageable. 3 OM3-L signs and 3 OM3-R signs should be installed to replace broken existing signs. Delineators should also be added along the edges of the deck and at each end of the bridge as a caution to drivers. There is major erosion around the edges of the bridge and should be addressed.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 3700 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

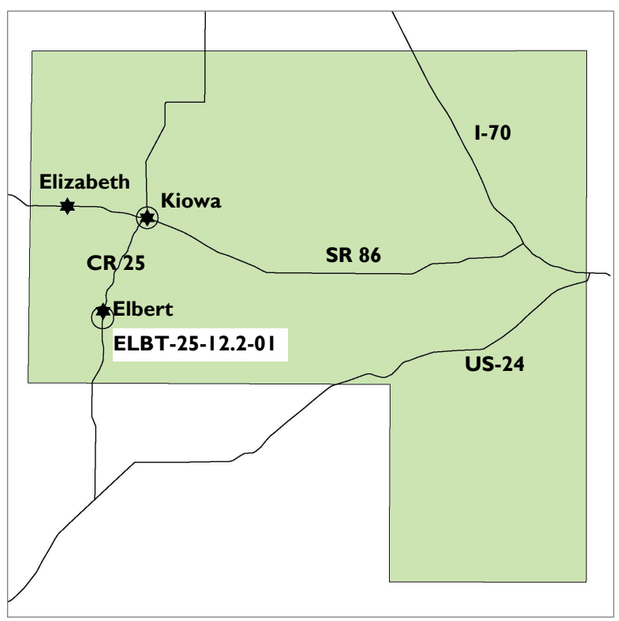
ELBT-25-12.2-01

CR 25 over West Kiowa Creek

Existing Structure Data

Age:	31 years (built 1987)
Structure Length:	168.5'
Width Out to Out:	28' (C/C 28')
No. of Lanes on Bridge:	2
Average Daily Traffic:	1745
Truck Traffic:	6%
Sufficiency Rating:	78.9
Deck Rating:	7
Superstructure Rating:	5
Substructure Rating:	7

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
6	Replace joint seal over Pier 2	$1,000
6	Clean and paint exterior girders, diaphragms, and all girder ends	$80,000
8	Epoxy inject cracks in Pier 2 to seal them against further corrosion	$4,000
10	Clean and paint bridge rail posts	$10,110
16	Replace bridge	$1,305,000
18	Mitigate corrosion encroaching on NE approach roadway	$400
20	Replace railing posts	$16,850
26	Patch potholes and deteriorated asphalt above compression joints	$2,000

Recommended Replacement Strategy

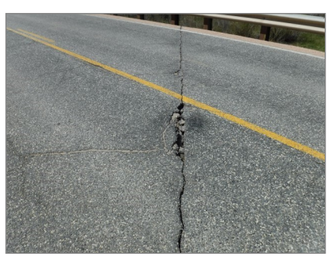
- Replacement Priority: 21
- Estimated Remaining Life: 20 years (if no repairs are made)
- # of spans and total length: 1-span 135' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete bulb-tee girders (BT63), 31'-0" out to out, 45° skew angle
- Substructure type (keep/replace): Remove existing pier. The abutments will likely need to be replaced even if they are in good condition due to the increased weight of a longer span.
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of one 12'-0" lane in each direction with 2'-0" shoulders on each side
- Estimated cost: $1,305,000

Photos of Existing Condition

The ends of all girders have R2 corrosion at Pier 2 because the roadway joint has failed.

Horizontal and vertical cracks are present across the pier. Spalling or incipient spalling has occurred on the north face of the east cantilever and corroded reinforcing is exposed.

Typical R2 laminating corrosion of steel bridge rail posts.



A crack has formed in the asphalt over Pier 2. The joint here has failed, allowing water to seep down to the steel girders and pier concrete.

Evaluations by Discipline

Structural:

The structure carries CR 25 over West Kiowa Creek. The deck and substructure have "Good" condition ratings, but the rating of the superstructure is only "Fair", indicating minor section loss in the steel members.

The inspection report identifies 3 feet of R2-R3 rust at the ends of all girders at Pier 2. The site visit on 8/14/18 also found spalling and delaminated concrete on Pier 2. A parge coat was applied to the exterior surface of Pier 2 at some point in the past; this parge coat is cracking and peeling in some areas, revealing concrete spalls and corroded reinforcing underneath. It is unclear how extensive the concrete cracking is underneath the parge coat.

The current structure has a very high load rating, but the geometry of the bridge is suboptimal for such a high-traffic major collector. A wider structure with shoulders adjacent to each lane should be considered when this bridge needs to be replaced.

The open joint over Pier 2 should be filled with an elastomeric joint sealant to protect the pier and girder ends from water and to slow the rate of deterioration. The girders should be cleaned and painted where the paint has failed. And the parge coat at Pier 2 should be removed so its current condition can be assessed.

Safety:

Overall safety at this bridge crossing is good. Paved 2-lane section with 1 to 2-foot clear zones in front of the guardrail at crossing. Visibility approaching the bridge is adequate from the north due to a sharp horizontal curve and vegetation overgrowth. Visibility is currently good from the south. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing.

Loose gravel on the outer 2-feet of the shoulders, under the guardrail is encouraging the growth of tall prairie grasses. This is prevalent on the both lanes where the grasses are high enough to encompass the guardrail and delineators. The northbound approach visibility is going to be compromised soon by a large cottonwood tree overhanging the roadway. Other trees and vegetation on the east side of the bridge will soon be compromising the southbound visibility even further. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 2040 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

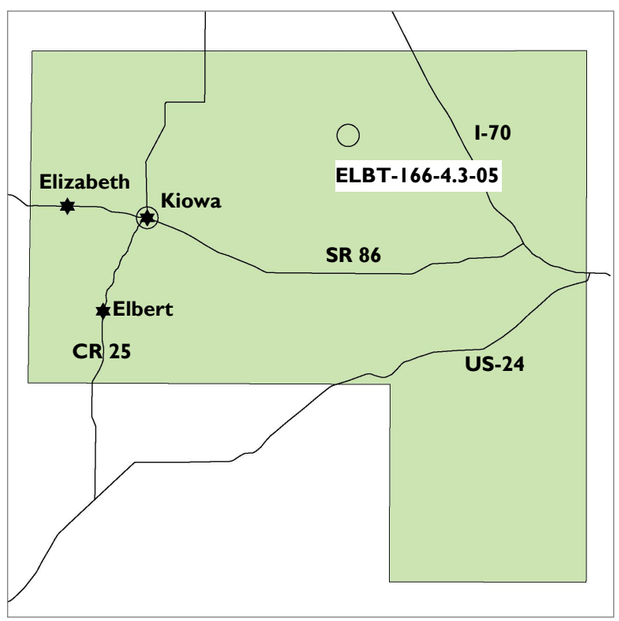
ELBT-166-4.3-05

CR 166 over Middle Bijou Creek

Existing Structure Data

Age:	53 years (built 1965)
Structure Length:	160'
Width Out to Out:	16.1' (C/C 14.5')
No. of Lanes on Bridge:	1
Average Daily Traffic:	13
Truck Traffic:	0%
Sufficiency Rating:	82
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
1	Install delineators along both edges of deck, full length of bridge	$1,000
16	Clean and spot paint piles	$6,000
24	Repair spalls at edges of girder top flanges	$48,000

Recommended Replacement Strategy

- Replacement Priority: 22
- Estimated Remaining Life: 20 years (if no repairs are made)
- Replacement Structure: Low water crossing
- Estimated cost: $94,000

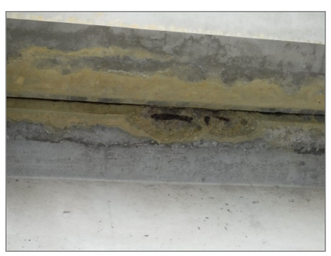
Bridge Replacement Alternative

- # of spans and total length: 2-span 160' bridge
- Type of structure, out-to-out, skew: Precast/prestressed concrete box girders (BX35x48), 20'-8" out to out, 0° skew angle
- Substructure type (keep/replace): Replace existing substructure. Use integral abutments on steel piles and concrete bent caps on steel piles
- Bridge rail type: Bridge rail Type 10
- Travelway details: Travelway consists of a single lane of traffic, 17'-8" wide
- Estimated cost: $682,000

Photos of Existing Condition

Typical R1 corrosion on piles and bracing members near groundline.

Most railing posts are bent and have rust at their base.



Typical spall with exposed and corroded rebar in bottom of top flanges.

Evaluations by Discipline

Structural:

The structure carries CR 166 over Middle Bijou Creek. The deck, superstructure and substructure all have "Satisfactory" condition ratings.

The current average daily traffic is 13 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

There are no major items of concern for this bridge. Light rust is present on the piles near the groundline, and this will need to be cleaned and repainted in the future. Minor edge spalling at the girder top flanges and some light efflorescence is present, but there are no significant signs of deterioration of the superstructure.

The existing structure is adequate to carry this rural local road and its light traffic demands. The recommended replacement option is a low water crossing, but pursuing this option will still incur a significant cost for removal of the existing structure. The most cost efficient approach to maintaining this water crossing is to keep the existing structure in good condition. The traffic demand is very small, and as long as corrosion is halted and repaired whenever it is discovered, this bridge could remain in service for a long time.

Safety:

Overall safety at this bridge is poor. Un-paved 2-lane approach sections with minimal clear zones adjacent to steep foreslope narrowing to tie into a one lane bridge. Visibility approaching the bridge is good from both directions. Railing on the bridge consists of a cable attached via metal pipe and eyelets. Some of the rail posts are bent and the metal cable is hanging over the bridge. There are proper object markers at all four corners of the crossing, and additional markers on the bridge.

Approaches are missing proper guardrail and appropriate signage for a one lane bridge. There is a dead tree inside the clear zone. Until proper railing can be installed, reflective tape or delineators should be affixed to the metal posts on the bridge. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 5040 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-25-7.61-03

CR 25 over Kiowa Creek Tributary

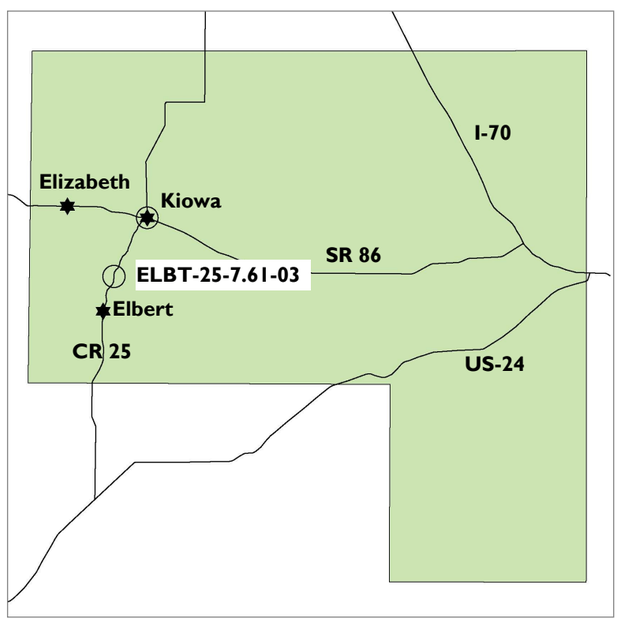
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
13	Install guardrails at structure location	$75,000
14	Clear silt from barrels 1 and 3	$200
14	Seal pipe 1 seam	$200
18	Repair and stabilize slope material at west end	$400

Existing Structure Data

Age:	39 years (built 1979)
Structure Length:	22.7'
Width Out to Out:	61'
No. of Lanes on Bridge:	2
Average Daily Traffic:	1473
Truck Traffic:	6%
Sufficiency Rating:	96.4
Culvert Rating:	6

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 23
- Estimated Remaining Life: 20 years
- Suggested Replacement Structure: Culvert
- Size: (3) - 72" CMP pipes
- Railing: Standard guardrail
- Travelway details: Travelway consists of one 12'-0" lane in each direction with 2'-0" shoulders on each side
- Estimated cost: $151,000

Photos of Existing Condition

Roadway above culverts. Guardrail has not been installed at the structure location.

Underside view of Pipe 3 showing large silt deposit.

A debris pile is present adjacent to Seam 1 in Pipe 1, suggesting that the seam is open and material is spilling through.

The slope above the culverts at the west end is sloughing.

Evaluations by Discipline

Structural:

The structure carries CR 25 over Kiowa Creek Tributary. The culverts have a "Satisfactory" condition rating and a sufficiency rating of 96.4, indicating that they are performing well.

As a buried structure, the effects of traffic loads are dampened by the soil surrounding the culverts. Average daily traffic should not have a large impact on the service life of the structure, which is more likely to be controlled by corrosion.

This location is usually dry and carries very small flows during storm events. After the existing structure reaches the end of its service life, it should be replaced with another culvert.

Safety:

Overall safety at this culvert crossing is very good. Paved 2-lane section with 4-foot shoulders at crossing. Visibility approaching the bridge is good from both directions. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing. Loose gravel on the outer 2-feet of the shoulders, under the guardrail is encouraging the growth of tall prairie grasses. This is very prevalent on the north bound lane where the grasses are high enough to encompass the guardrail and delineators. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone X floodplain.
- 100-year peak flood flow is 228 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

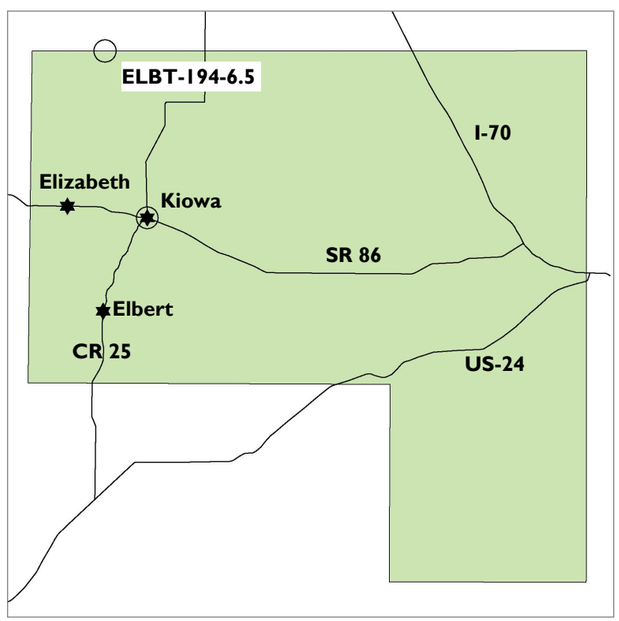
ELBT-194-6.5

CR 194 over Boxelder Creek

Existing Structure Data

Age:	37 years (built 1981)
Structure Length:	32.2'
Width Out to Out:	36' (C/C 34.3')
No. of Lanes on Bridge:	2
Average Daily Traffic:	1528
Truck Traffic:	9%
Sufficiency Rating:	99.9
Deck Rating:	6
Superstructure Rating:	6
Substructure Rating:	7

Vicinity Map



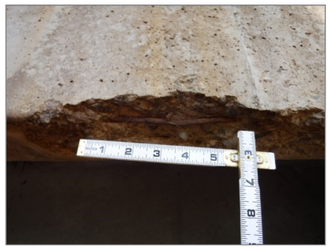
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
3	Repair spalls with exposed PS strand in Girders A and L in stem near bearing	$3,000

Recommended Replacement Strategy

- Replacement Priority: 24
- Estimated Remaining Life: 30 years (if no repairs are made)
- Replacement does not need to be considered at this time

Photos of Existing Condition



Spall with exposed and severely corroded prestressing strand at bottom of stem in Girder A near Abutment 1.

Evaluations by Discipline

Structural:

The structure carries CR 194 over Boxelder Creek. The deck, superstructure and substructure all have "Good" or "Satisfactory" condition ratings. In addition to the favorable condition, the sufficiency rating of 99.9 indicates that the bridge meets the serviceability requirements of CR 194.

The current average daily traffic is 1528 vehicles with 9% truck traffic. This is a large volume of truck traffic, and the location of this bridge within an area of high development pressure could increase this number dramatically in the next few decades.

A spall has occurred at the base of the stem of Girder A near Abutment 1 which has exposed the prestressing strand. The strand is severely corroded and appears to have lost tension locally. Because the spall is located close to the abutment, the loss of steel area will not have an impact on the girder capacity. However, the corrosion can spread through the girder and eventually weaken of detension the strand near midspan. The remaining exposed strand should be cleaned and cathodic protection should be added before the spall is repaired.

Safety:

Overall safety at this bridge crossing is good. Paved 2-lane section with 2 to 4-foot clear zones in front of the guardrail at crossing. Visibility approaching the bridge is adequate from both directions. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing.

Loose gravel on the outer 2-feet of the shoulders, under the guardrail is encouraging the growth of tall prairie grasses. This is prevalent on the both lanes where the grasses are high enough to encompass the guardrail and delineators. Trees and vegetation on both sides of the bridge will soon be compromising visibility. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 5690 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-98-0.20-2A

CR 98 over Kiowa Creek

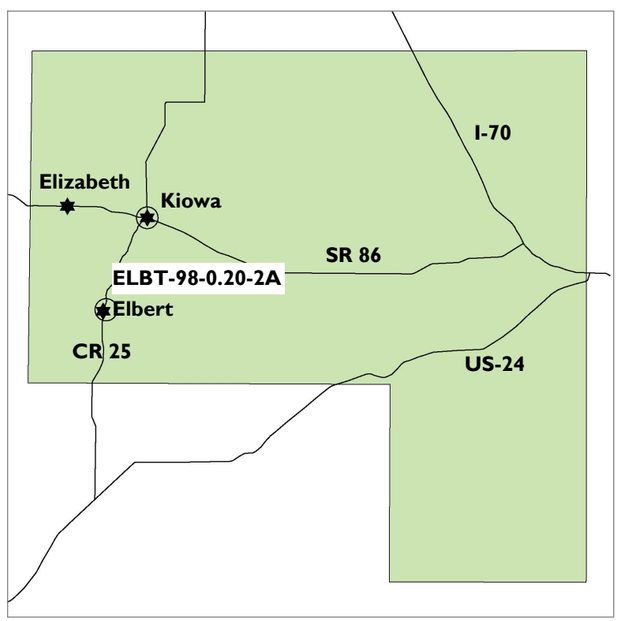
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
10	Remove vegetation from channel	$250
13	Install guardrails at bridge location	$50,000
14	Clear silt from barrels 1 and 3	$500

Existing Structure Data

Age:	16 years (built 2002)
Structure Length:	25.3'
Width Out to Out:	62'
No. of Lanes on Bridge:	2
Average Daily Traffic:	467
Truck Traffic:	6%
Sufficiency Rating:	96.9
Culvert Rating:	6

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 25
- Estimated Remaining Life: 35 years
- Replacement does not need to be considered at this time

Photos of Existing Condition

Vegetation is growing at the upstream and downstream entrances to the culvert pipes.

End of Pipe 1 showing heavy silt accumulation.

Evaluations by Discipline

Structural:

The structure carries CR 98 over Kiowa Creek. The culverts have a "Satisfactory" condition rating and a sufficiency rating of 96.9, indicating that they are performing well.

As a buried structure, the effects of traffic loads are dampened by the soil surrounding the culverts. Average daily traffic should not have a large impact on the service life of the structure, which is more likely to be controlled by corrosion or washout from a major storm event.

Running water is usually present in the culverts and the Structure Inspection and Inventory Report classifies the waterway adequacy as "slight chance of overtopping bridge deck and roadway approaches". After the existing structure reaches the end of its service life, it should be replaced with larger diameter culverts.

Safety:

Overall safety at this culvert crossing is adequate. Un-paved 2-lane section with minimal clear zones. There are no guardrails, object markers or delineation of any type to note drop off. Visibility approaching the crossing is good from both directions. Foreslope is not recoverable at crossing. Recommend installing signs, delineators, guardrail or some combination of all three.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 2950 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

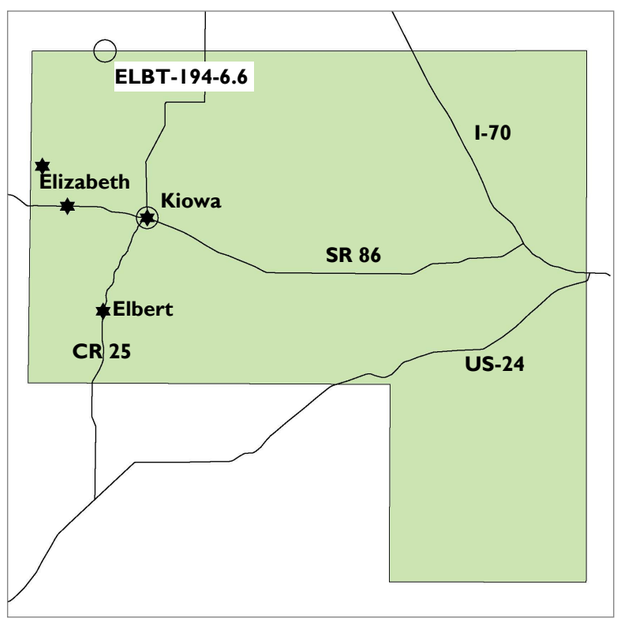
ELBT-194-6.6

CR 194 over Boxelder Creek

Existing Structure Data

Age:	37 years (built 1981)
Structure Length:	62.7'
Width Out to Out:	36.3' (C/C 34.5')
No. of Lanes on Bridge:	2
Average Daily Traffic:	1528
Truck Traffic:	9%
Sufficiency Rating:	94.3
Deck Rating:	7
Superstructure Rating:	7
Substructure Rating:	7

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost

Recommended Replacement Strategy

- Replacement Priority: 26
- Estimated Remaining Life: 40+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition

Light efflorescence on bottom of Girder B due to water penetration.

Evaluations by Discipline

Structural:

The structure carries CR 194 over Boxelder Creek. The deck, superstructure and substructure all have "Good" condition ratings. In addition to the favorable condition, the sufficiency rating of 94.3 indicates that the bridge meets the serviceability requirements of CR 194.

The current average daily traffic is 1528 vehicles with 9% truck traffic. This is a large volume of truck traffic, and the location of this bridge within an area of high development pressure could increase this number dramatically in the next few decades.

Currently, there are no items of concern. General maintenance should be performed to ensure that the bridge reaches its potential service life.

Safety:

Overall safety at this bridge crossing is good. Paved 2-lane section with 2 to 4-foot clear zones in front of the guardrail at crossing. Visibility approaching the bridge is adequate from both directions. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing.

Loose gravel on the outer 2-feet of the shoulders, under the guardrail is encouraging the growth of tall prairie grasses. This is prevalent on the both lanes where the grasses are high enough to encompass the guardrail and delineators. Trees and vegetation on both sides of the bridge will soon be compromising visibility. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 5690 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

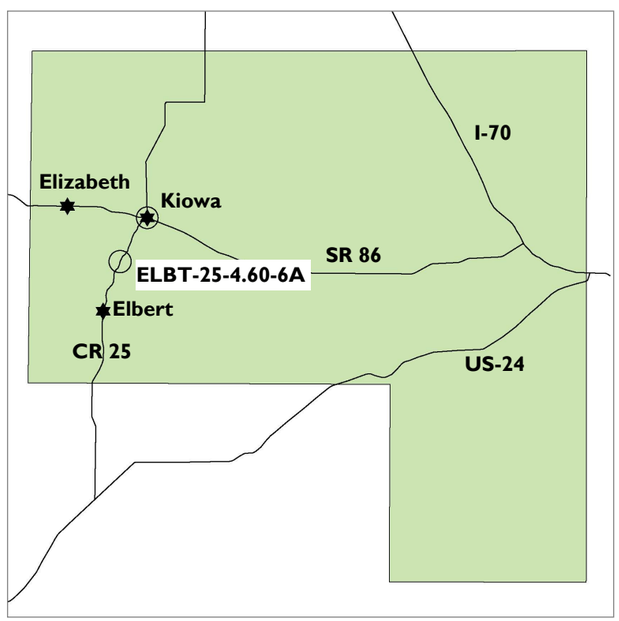
ELBT-25-4.60-6A

CR 25 over Kiowa Creek Tributary

Existing Structure Data

Age:	20 years (built 1998)
Structure Length:	26.6'
Width Out to Out:	86.2'
No. of Lanes on Bridge:	2
Average Daily Traffic:	1473
Truck Traffic:	6%
Sufficiency Rating:	99.4
Culvert Rating:	7

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
14	Clean out sediment in bottom of CMPs	$200

Recommended Replacement Strategy

- Replacement Priority: 27
- Estimated Remaining Life: 40+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition

Underside view of Cell 2 showing sediment gathering at base.

Evaluations by Discipline

Structural:

The structure carries CR 25 over Kiowa Creek Tributary. The culverts have a "Good" condition rating and a sufficiency rating of 99.4, indicating that they are performing well.

As a buried structure, the effects of traffic loads are dampened by the soil surrounding the culverts. Average daily traffic should not have a large impact on the service life of the structure, which is more likely to be controlled by corrosion.

This location is usually dry and carries very small flows during storm events. After the existing structure reaches the end of its service life, it should be replaced with another culvert.

Safety:

Overall safety at this culvert crossing is very good. Paved 2-lane section with 6-foot shoulders at crossing. Visibility approaching the bridge is good from both directions. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing. Loose gravel on the outer 2-feet of the shoulders, under the guardrail is encouraging the growth of tall prairie grasses.

Only noticeable safety concerns are driveway accesses on the NW, NE and SE corners right in front of the guardrail terminals without any signage or markers. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone X floodplain.
- 100-year peak flood flow is 214 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-150-3.6-02

CR 150 over West Bijou Creek

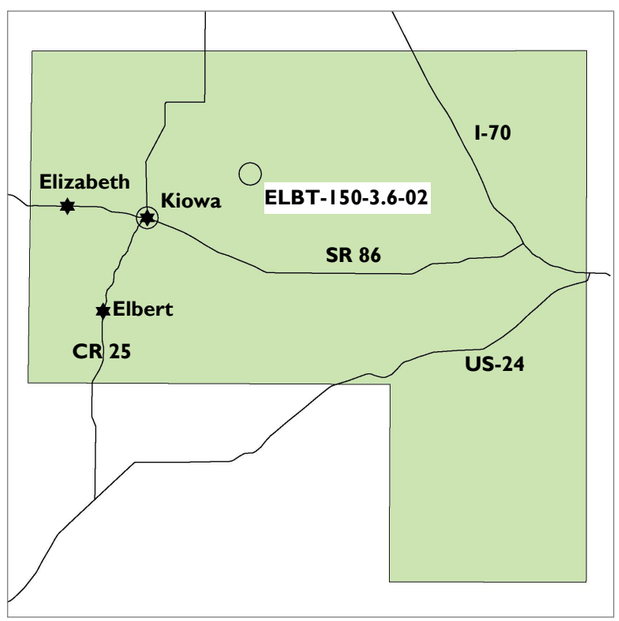
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
3	Cut all web plate tabs at piers	$3,600
12	Seal concrete deck and add waterproofing	$25,600
14	Spot paint steel girders and piles	$17,500
20	Place riprap around Pier 5 piles to protect against scour	$4,000
20	Place fill at undermined section of Abutment 1	$200

Existing Structure Data

Age:	28 years (built 1990)
Structure Length:	293.9'
Width Out to Out:	29' (C/C 28.2')
No. of Lanes on Bridge:	2
Average Daily Traffic:	239
Truck Traffic:	0%
Sufficiency Rating:	99.7
Deck Rating:	6
Superstructure Rating:	7
Substructure Rating:	6

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 28
- Estimated Remaining Life: 50+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition

Girder web tab on Girder F is fully cracked at bearing location, Pier 7

Paint is chipping off of the web of Girder B at Pier 5 on the opposite side from the web tab welds. This is common at the web tab locations.

Hairline to 0.03 inch map cracking throughout east half of bridge.

2 foot deep local scour at Pier 5. Base of piles is also corroded.

Evaluations by Discipline

Structural:

The structure carries CR 150 over West Bijou Creek. The deck, superstructure and substructure all have "Good" or "Satisfactory" condition ratings.

The current average daily traffic is 239 vehicles with no trucks. This current traffic volume is relatively low, and without the impact of truck traffic the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

Plates were welded to the webs of steel girders in adjacent spans at the bearing locations, presumably at the time of erection. These plates have cracked in numerous locations and have caused the paint to pop off of the girder webs opposite the plates. These web plates should all be removed to ensure that no cracks extend into the girders themselves. Riprap should be placed at Pier 5 in the future to protect those piles from scour, and the undermined section of Abutment 1 should be filled in.

Safety:

Overall safety at this bridge crossing is good. Un-paved 2-lane section with 2-foot shoulders. Bridge is wide enough for two lane traffic with clear zones. Visibility approaching the bridge is adequate from the west due to a sharp horizontal curve and vegetation/tree overgrowth. Visibility is currently good from the east. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing.

Loose gravel on the outer 2-feet of the shoulders, under the guardrail is encouraging the growth of tall prairie grasses. This is prevalent on the both lanes where the grasses are high enough to encompass the guardrail and delineators. The eastbound approach visibility is compromised by a large cottonwood tree overhanging the roadway. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 14900 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

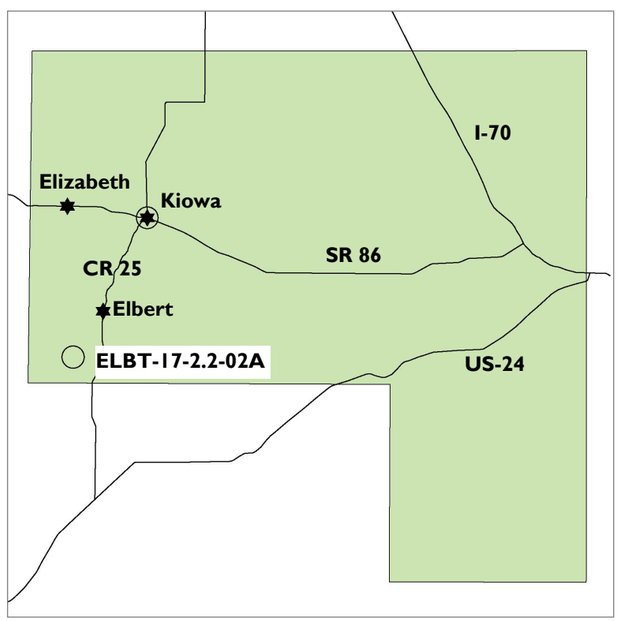
ELBT-17-2.2-02A

CR 17 over West Kiowa Creek

Existing Structure Data

Age:	30 years (built 1988)
Structure Length:	171.7'
Width Out to Out:	31.3' (C/C 28.2')
No. of Lanes on Bridge:	2
Average Daily Traffic:	89
Truck Traffic:	0%
Sufficiency Rating:	100
Deck Rating:	7
Superstructure Rating:	6
Substructure Rating:	6

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
10	Remove vegetation from channel	$2,000
12	Seal cracks in bridge deck overlay, add waterproofing sealant	$16,100
14	Patch spalls in diaphragms over piers	$9,000
16	Clean and spot paint piles where paint has failed	$2,100

Recommended Replacement Strategy

- Replacement Priority: 29
- Estimated Remaining Life: 50+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition

Vegetation, including large bushes and a tree, is growing in the channel on both the upstream and downstream sides of the bridge. This should be removed to allow clear passage of stormwater.

The compression joint at Abutment 1 is filled with gravel and is torn in the wheel lines.

Spalls in diaphragm C at Pier 3.

The steel piles have R1 corrosion at water and groundline.

Evaluations by Discipline

Structural:

The structure carries CR 17 over West Kiowa Creek. The deck, superstructure and substructure all have "Good" or "Satisfactory" condition ratings. In addition to the favorable condition, the sufficiency rating of 100 indicates that the bridge meets the serviceability requirements of CR 17

The current average daily traffic is 89 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge is likely to have a minimal effect on the longevity of this type of modern structure, with corrosion being more likely to control the service life. However, this bridge is in a region of high development pressure, and the usage of the road may change within the bridge's lifetime.

Currently, there are no items of concern. General maintenance should be performed to ensure that the bridge reaches its potential service life. Remove the vegetation from around the bridge to create a free flowing channel.

Safety:

Overall safety at this bridge is good. The width on the bridge is adequate for passing vehicles. Visibility approaching the bridge is good from both directions. Guardrail on the bridge and approaches are in good repair with proper end terminals. One concern is that the bridge is covered with several inches or more of dirt and gravel and it has been graded to the front of the guardrail. This has created concerns with the guardrail not being at the proper height above the travel surface to properly stop a vehicle and storm run-off has been compromised, creating deep channels along the approaches and on the bridge.

Object marker signs are at all four corners of the bridge and delineators on the guardrail need to be cleaned. Do to the steep fore-slopes approaching the bridge, adding delineators is recommended for both approaches.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 1530 cubic feet per second.

ELBT-74-1.90-01

CR 74 over West Bijou Creek

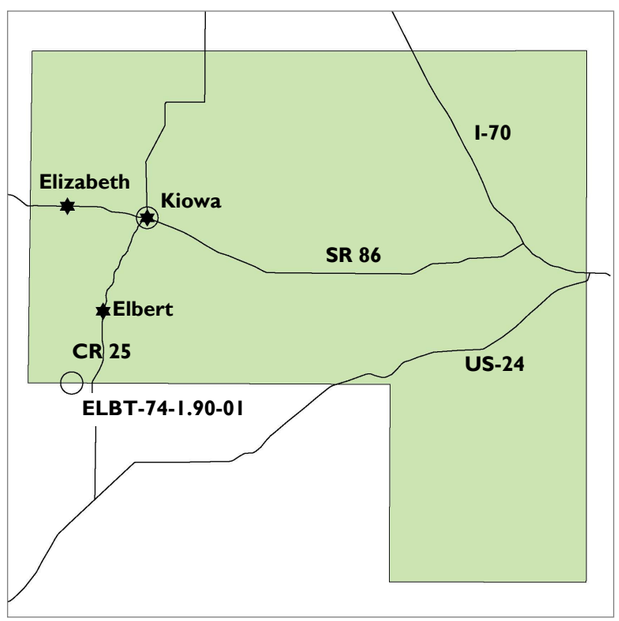
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
10	Remove vegetation from channel	$2,000
12	Seal cracks in deck overlay and add waterproofing	$14,100
14	Patch spall in bottom of top flange of Girder 1B	$150
16	Clean and spot paint piles	$4,200

Existing Structure Data

Age:	29 years (built 1965)
Structure Length:	150.8'
Width Out to Out:	31.2' (C/C 28.2')
No. of Lanes on Bridge:	2
Average Daily Traffic:	78
Truck Traffic:	0%
Sufficiency Rating:	100
Deck Rating:	7
Superstructure Rating:	6
Substructure Rating:	7

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 29
- Estimated Remaining Life: 50+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition

Thick vegetation is present across the channel at both the upstream and downstream sides of the bridge.

Longitudinal and transverse cracking is typical in the asphalt wearing surface.

The paint is failing in locations on the steel piles.

Evaluations by Discipline

Structural:

The structure carries CR 74 over West Bijou Creek. The deck, superstructure and substructure all have "Good" or "Satisfactory" condition ratings. In addition to the favorable condition, the sufficiency rating of 100 indicates that the bridge meets the serviceability requirements of CR 74.

The current average daily traffic is 78 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge is likely to have a minimal effect on the longevity of this type of modern structure, with corrosion being more likely to control the service life. However, this bridge is in a region of high development pressure, and the usage of the road may change within the bridge's lifetime.

Currently, there are no items of concern. General maintenance should be performed to ensure that the bridge reaches its potential service life.

Safety:

Overall safety at this bridge is good. The width on the bridge is adequate for passing vehicles. Visibility approaching the bridge is good from both directions. Guardrail on the bridge and approaches are in good repair with proper end terminals. One concern is that the bridge is covered with several inches or more of dirt and gravel and it has been graded to the front of the guardrail. This has created concerns with the guardrail not being at the proper height above the travel surface to properly stop a vehicle and storm run-off has been compromised, creating deep channels along the approaches and on the bridge.

Object marker signs are missing at two corners of the bridge and delineators on the guardrail need to be cleaned. Do to the steep fore-slopes approaching the bridge, adding delineators is recommended for both approaches.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 1130 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

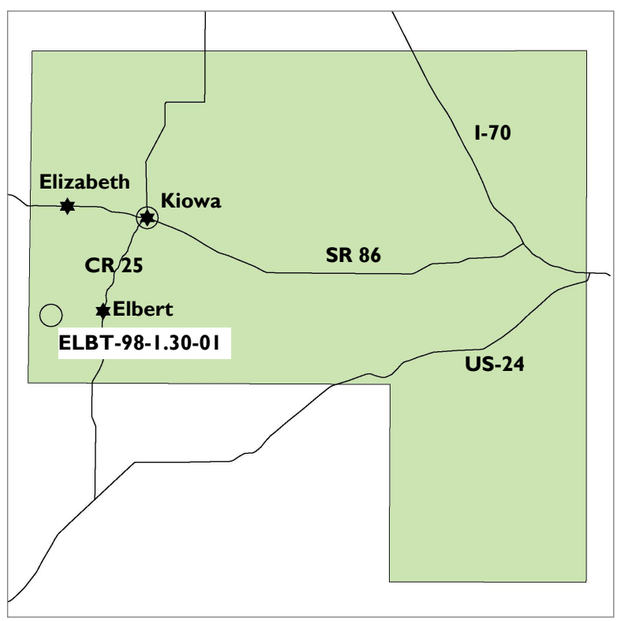
ELBT-98-1.30-01

CR 98 over Running Creek

Existing Structure Data

Age:	28 years (built 1990)
Structure Length:	85.3'
Width Out to Out:	32.8' (C/C 30.3')
No. of Lanes on Bridge:	2
Average Daily Traffic:	240
Truck Traffic:	0%
Sufficiency Rating:	100
Deck Rating:	7
Superstructure Rating:	7
Substructure Rating:	7

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
12	Replace compression joint seal and Abutment 1	$820
12	Seal cracks in deck and add waterproofing	$8,400
24	Clean and spot paint bottom flange of girders	$3,300

Recommended Replacement Strategy

- Replacement Priority: 29
- Estimated Remaining Life: 50+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition

Light cracking and scaling throughout deck.

Compression seal at southwest corner of Abutment 1 is missing for 4 feet.

Evaluations by Discipline

Structural:

The structure carries CR 98 over Running Creek. The deck, superstructure and substructure all have "Good" condition ratings. In addition to the favorable condition, the sufficiency rating of 100 indicates that the bridge meets the serviceability requirements of CR 98.

The current average daily traffic is 240 vehicles with no trucks. This current traffic volume is relatively low, but this bridge is in a region of high development pressure and the usage of the road may change within the bridge's lifetime. The 2008 West Elbert County Transportation Master Plan identified CR 98 as a potential collector route with a substantially higher ADT following future development..

Currently, there are no items of significant concern. General maintenance should be performed to ensure that the bridge reaches its potential service life. The compression joint at Abutment 1 should be repaired in the near future to prevent water from collecting in the bearing area.

Safety:

Overall safety at this bridge crossing is good. Un-paved 2-lane section with minimal clear zones in front of the guardrail at crossing. Bridge is wide enough for two lane traffic. Visibility approaching the bridge is adequate from the east due to a horizontal and vertical curve. Visibility is currently good from the west. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing.

Evidence of major erosion on approaches, especially the east side. Recommend signage for west bound approach including steep hill, curve ahead and chevron signs at the curve. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 1070 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

ELBT-174-4.4-1A

CR 174 over West Bijou Creek

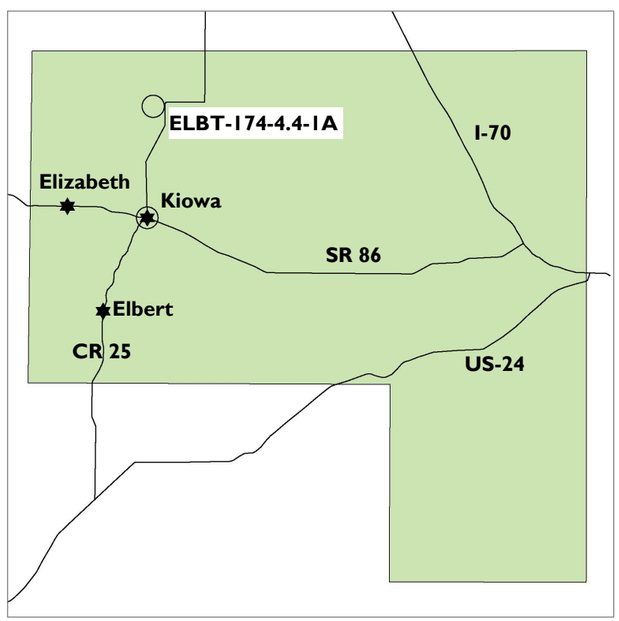
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
12	Seal cracks in bridge deck overlay and add waterproofing	$20,400
24	Repaint steel girders	$177,600

Existing Structure Data

Age:	26 years (built 1992)
Structure Length:	222.2'
Width Out to Out:	30.6' (C/C 27.9')
No. of Lanes on Bridge:	2
Average Daily Traffic:	188
Truck Traffic:	0%
Sufficiency Rating:	99.9
Deck Rating:	7
Superstructure Rating:	8
Substructure Rating:	7

Vicinity Map



Recommended Replacement Strategy

- Replacement Priority: 32
- Estimated Remaining Life: 50+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition

Typical hairline cracking in bridge deck overlay.

Evaluations by Discipline

Structural:

The structure carries CR 174 over West Bijou Creek. The deck, superstructure and substructure all have "Good" condition ratings. In addition to the good condition, the sufficiency rating of 99.9 indicates that the bridge meets the serviceability requirements of CR 174.

The current average daily traffic is 188 vehicles with no trucks. This current traffic volume is relatively low, and without the impact of truck traffic the daily usage of the bridge will likely be a minor contributor to structural deterioration. Road salts and water penetration will have the largest impact on the longevity of the bridge.

Currently, there are no items of concern. General maintenance should be performed to ensure that the bridge reaches its potential service life.

Safety:

Overall safety at this bridge crossing is adequate. Un-paved 2-lane section with 2-foot shoulders. Bridge is wide enough for two lane traffic with clear zones. Visibility approaching the bridge is adequate from the west due to a sharp vertical curve and vegetation/tree overgrowth. Visibility is currently good from the east. Guardrail on the bridge and approaches are in good repair with proper end terminals. Object markers at all four corners of the crossing.

There is a great deal of erosion compromising the eastbound approach. Cattle are often on the roadway near this bridge, so cow crossing sign would be advisable. Delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 6580 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

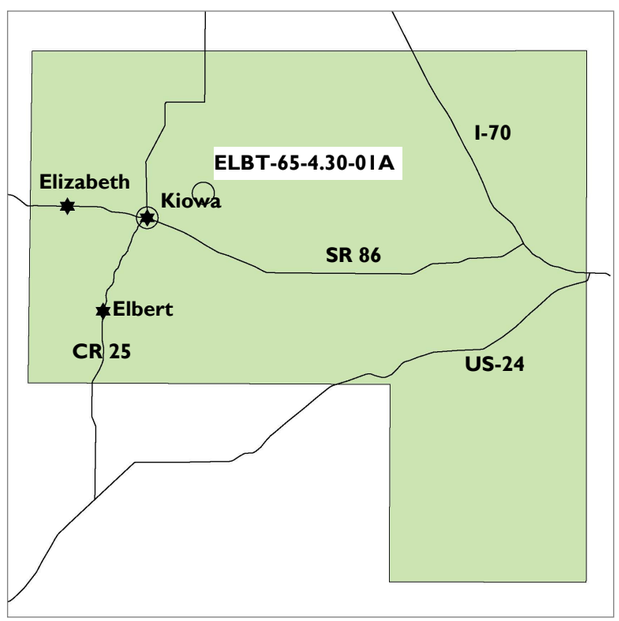
ELBT-65-4.30-01A

CR 65 over Comanche Creek

Existing Structure Data

Age:	31 years (built 1987)
Structure Length:	105’
Width Out to Out:	30.5’ (C/C 28’)
No. of Lanes on Bridge:	2
Average Daily Traffic:	306
Truck Traffic:	4%
Sufficiency Rating:	97.8
Deck Rating:	7
Superstructure Rating:	8
Substructure Rating:	7

Vicinity Map



Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
4	Replace fill and place riprap at eroded berms in front of both abutments and wingwalls	$2,000

Recommended Replacement Strategy

- Replacement Priority: 33
- Estimated Remaining Life: 50+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition

The northwest corner of Abutment 1 has substantial erosion, exposing the underside of the abutment cap.

Larger view of northwest corner showing erosion of embankment slope.

Evaluations by Discipline

Structural:

The structure carries CR 65 over Comanche Creek. The deck, superstructure and substructure all have "Good" condition ratings. In addition to the good condition, the sufficiency rating of 97.8 indicates that the bridge meets the serviceability requirements of CR 65

The current average daily traffic is 306 vehicles with 4% trucks, which is a small taffic demand for the modern design used here. This bridge is in on a minor collector in an area of low development pressure, so the traffic is unlikely to change drastically in the near future.

The soil around the SW corner of the abutment has been severely eroded, exposing the underside of the abutment cap. Minor erosion has occurred at the NW corner, exposing a small corner of the base of the abutment cap. Structural fill should be placed in these corners to restore soil cover in front of the abutment caps and riprap should be added to prevent future erosion.

Safety:

Overall safety at this bridge crossing is good. Un-paved 2-lane section with minimal clear zones in front of the guardrail at crossing. Visibility approaching the bridge is adequate from the north due to a sharp horizontal curve. Visibility is adequate from the south due to sharp horizontal curve but is mitigated with several chevron signs. Guardrail on the bridge and approaches are in fair condition with proper end terminals. Several section of the guardrail is bent with cracked posts. Proper object markers at all four corners of the crossing, but two of them have been shot up and should be replaced.

Loose gravel on the outer section of the clear zones, under the guardrail is encouraging the growth of tall prairie grasses. This is prevalent on the both lanes where the grasses are high enough to encompass the guardrail and delineators. Grading, with a berm at the outer edge of the roadway is also preventing proper drainage. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 2660 cubic feet per second.
- A low water crossing was not considered due to the importance of this route.

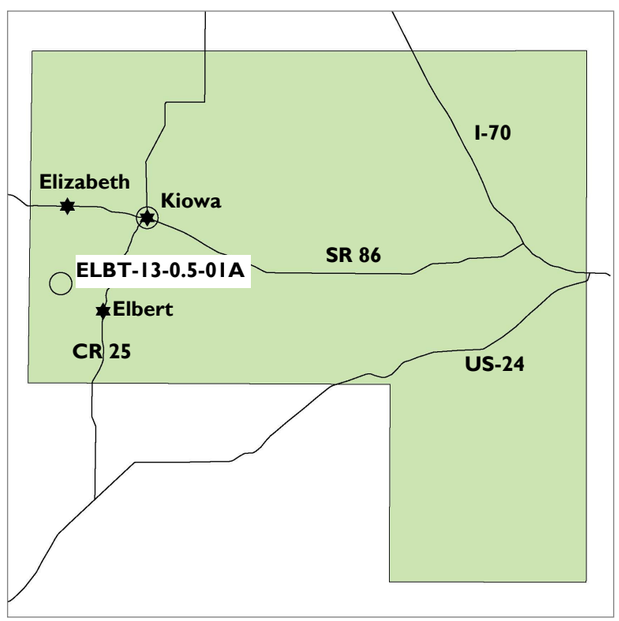
ELBT-13-0.5-01A

CR 13 over Running Creek

Existing Structure Data

Age:	30 years (built 1988)
Structure Length:	104'
Width Out to Out:	29.2' (C/C 26.3')
No. of Lanes on Bridge:	2
Average Daily Traffic:	24
Truck Traffic:	0%
Sufficiency Rating:	99
Deck Rating:	7
Superstructure Rating:	8
Substructure Rating:	8

Vicinity Map



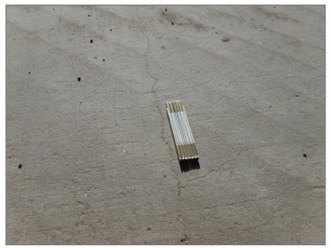
Recommended Repair Actions to Extend Service Life

Priority	Action	Estimated Cost
12	Seal cracks in deck and add waterproofing	$9,100
12	Clean and repair compression joint at south abutment	$1,000

Recommended Replacement Strategy

- Replacement Priority: 34
- Estimated Remaining Life: 50+ years
- Replacement does not need to be considered at this time

Photos of Existing Condition



Hairline to 0.06" pattern cracking in top of deck. The deck should be sealed to prevent saturation of the concrete.

The compression joint at Abutment 1 is filled with gravel and is torn in the wheel lines. The joint should be cleaned and repaired.

Evaluations by Discipline

Structural:

This structure carries CR 13 over Running Creek. The deck, superstructure and substructure all have "Good" condition ratings. In addition to the good condition, the sufficiency rating of 99 indicates that the bridge meets the serviceability requirements of CR 13.

The current average daily traffic is 24 vehicles with no trucks. Such a small traffic count means that the daily usage of the bridge is likely to have a minimal effect on the longevity of this type of modern structure, with corrosion being more likely to control the service life. However, this bridge is in a region of high development pressure, and the usage of the road may change within the bridge's lifetime.

Currently, there are no items of concern. General maintenance should be performed to ensure that the bridge reaches its potential service life. The compression joint at the south abutment should be repaired in the near future to prevent water from collecting in the bearing area.

Safety:

Overall safety at this bridge crossing is good. Un-paved 2-lane section with minimal 2-foot clear zones in front of the guardrail at crossing. Visibility approaching the bridge is good from both directions. Guardrail on the bridge and approaches are in fair condition with proper end terminals. Proper object markers at all four corners of the crossing, but two of them have been shot up and should be replaced.

Loose gravel on the outer section of the clear zones, under the guardrail is encouraging the growth of tall prairie grasses. This is prevalent on the both lanes where the grasses are high enough to encompass the guardrail and delineators. Grading, with a berm at the outer edge of the roadway is also preventing proper drainage. Due to the steep fore-slopes, delineators leading into the bridge from both directions would also improve safety during night driving or poor weather.

Drainage/Hydraulics:

Hydraulic conditions identified at this bridge location include:

- Structure is in a FEMA Zone A floodplain.
- 100-year peak flood flow is 1680 cubic feet per second.