ASSESSMENT OF HEC-18 SCOUR EQUATIONS

FOR BOTTOMLESS CULVERTS BASED

ON KANSAS FIELD DATA

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AN ABSTRACT IN A UNIVERISTY OF MISSOURI-KANSAS CITY THESIS: ASSESSMENT OF THE HEC-18 SCOUR EQUATIONS FOR BOTTOMLESS CULVERTS BASED ON KANSAS FIELD DATA

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ABSTRACT

One of the main causes of bridge failure is scour at the abutments or piers. Scour is caused by increased velocities of water through bridge openings. Sediment is carried away from the foundations by high flows causing the bridge to become unstable and possibly collapse. Bottomless culverts have become an attractive bridge option and until recently studies to determine scour at their abutments are scarce. New studies have been conducted and need field review. The purpose of this report is to verify the validity of bottomless culvert equations derived from laboratory studies. Given the likely increase in interest in bottomless culverts, finding the right equations to use for the design of foundations becomes crucial. The advantage of this study is the abundant field data available for a comparison through the Kansas Department of Transportation project headed by TranSystems. A subset of bridges is tested with the equations and comparisons are made.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Civil Engineering have examined a thesis titled “Scour at Bottomless Culverts” presented by Mohammad Ali Bayazid, candidate for the Master of Science degree, and certify that in their opinion it is worthy of acceptance.

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CHAPTER 1

INTRODUCTION

Bridge safety has become one of the major concerns of municipalities, private businesses, and governing agencies all over the country. From railroad bridges to highway to local to pedestrian bridges, safely and economically designing these bridges to withstand a major event is on the mind of the designers, the constructors and the owners. There are several types of bridges that can accommodate the need for a water passageway, some of which can be very large. In some states such as Kansas, where there are a tremendous amount of small streams, the need for a smaller solution for water passageways calls for an economical and effective bridge. Culverts are generally used for these situations but changing the natural stream bottom to concrete is becoming more difficult with the rise in awareness to fish passage and stream obstruction (Arneson et al., 2012). Bottomless culverts offer a solution to some of these concerns in that they can be economically attractive and that they use the natural stream bottom as the "floor" of the bridge.

Bottomless culverts are three-sided structures that use the channel as the bottom, therefore having no "constructed" bottom. Having a natural channel bottom provides an environmentally advantageous alternative to box, pipe, and pipe arch culvert designs especially since there are increasing restrictions on channel obstruction. Many states that have certain types of fish or wildlife in their streams are requiring either bottomless culverts or embedding conventional culverts to mimic the natural stream bottom. Bottomless culverts range in size from a few feet to more than 35 feet in width. Estimating scour at these structures is as important as any other structure due to the potentially dangerous outcomes in case of failure. Overdesigning bottomless culverts can significantly increase design and

construction costs, therefore accurately estimating scour and failure potential is an important aspect of the design.

There are over 20,000 bridges in the state of Kansas that are considered off-system bridges. These bridges can range from 20 feet in length to over 200 feet. The largest of these bridges, multi-span bridges, usually have spread footer foundations that are keyed into bedrock or supported with piling that is driven to bedrock. Any bridge that has an integrated concrete floor is considered a culvert in the state of Kansas. Some bridges are neither multi-span nor do they have an integrated concrete floor, this category called single span bridges are the topic of interest for this report. Single span bridges are unique because instead of a concrete floor they have the channel bottom as the floor. Some single spans have vertical walls with wings that are beveled at a 1:1 flare as their abutments. This particular type of bridge, called a bottomless culvert, is lacking field data for calibration with laboratory studies.

Scour is one of the most important aspects of bridge design due to the potential harm that can be caused by failing to detect and mitigate it. The cost of rebuilding bridges damaged due to extensive scour and erosion is much greater than the cost of bridge inspections and countermeasures that detect and mitigate scour. The public safety aspect of bridge failure cannot be measured, as such scour detection and mitigation has become a priority. After the incidents at the Hatchie and Schoharie bridges, scour is now accounted for in design and maintenance of bridges across the country. Estimating scour depths using equations developed by hydraulic engineers is the common method used in bridge design. Bottomless culverts traditionally use the abutment scour equations to estimate scour depths at the entrance, exit, and inside the bridge. These estimates are generally very conservative and

yield depths that are rarely seen in the field. This report will attempt to shed some light on this matter.

Laboratory studies were conducted by the FHWA for determining scour depths at bottomless culverts. The studies were used to determine the location and magnitude of the scour holes formed at these bridges. There were some limitations to the study that require further analysis and research, one of which was field verification of results. Conducting studies on existing bottomless culverts in the field is an expensive and difficult endeavor. Site visits to various bridges with data collection and processing would be necessary for a viable study to produce the required information to verify the validity of the laboratory studies. Due to the robustness of a project launched by Kansas Department of Transportation (KDOT) with engineering consulting efforts of several firms lead by TranSystems (TSC), this type of data was readily available. This research was done external to the KDOT and TSC project with supervision by University of Missouri Kansas City professors.

The study conducted by the FHWA and featured in the latest version of HEC-18, only accounted for clear water and unsubmerged conditions. Long term degradation was not taken into account in the final scour depths found. Bridges chosen for this study showed no evidence of frequent overtopping and had alluvial channel beds. Bedrock channel beds were avoided to mimic lab studies. A group of bridges was sifted down based on laboratory criteria and the equations derived from the studies were used to find calculated scour depths. The location and depth of the scour holes at these bridges were compared to the calculated scour depths. Graphs were created to determine how accurate the laboratory equations were.

The results were very encouraging because all of the results were conservative and some bridges had negligible differences between measured and calculated scour depths.

There are several possible reasons for the difference between the field and laboratory results and they are discussed in the conclusions section of this report. The two major differences found in this study stem from not accounting for the cohesive properties of soil and the width to height ratio of the bridge entrance. The bridges that closely mimic the laboratory study in these two aspects yielded the lowest difference between measured and calculated scour depths.

The need for further research is always present, hence the expression ‘the more we know the more we don’t know.’ Areas of possible research and data expansion are in the submerged conditions for bottomless culverts as well as live bed conditions. There are other areas discussed in the potential future work section of this report and it is likely that future research will yield more questions than answers, but the safety and accuracy of design will only be enhanced.

CHAPTER 2

LITERATURE REVIEW

Calculating scour at bottomless culverts is similar to calculating scour at bridge abutments in many ways, one of which is that they can both be overestimated. Also flow distribution in the channel and on the flood plain approaching the inlet of a bottomless culvert is similar to that of a channel contracted by vertical-wall abutments at a bridge. Upstream cross-sections are generally wider than the culvert width and the flow velocities in the channel are lower than the velocities in the culvert.

Figure 1 shows the flow regime as it approaches a culvert entrance. The primary flow is diverted and forced into the culvert entrance. The flow is forced to contract through the culvert increasing pressure directly upstream of the culvert and decreasing velocities. As the pressure is reduced through the culvert velocities increase.

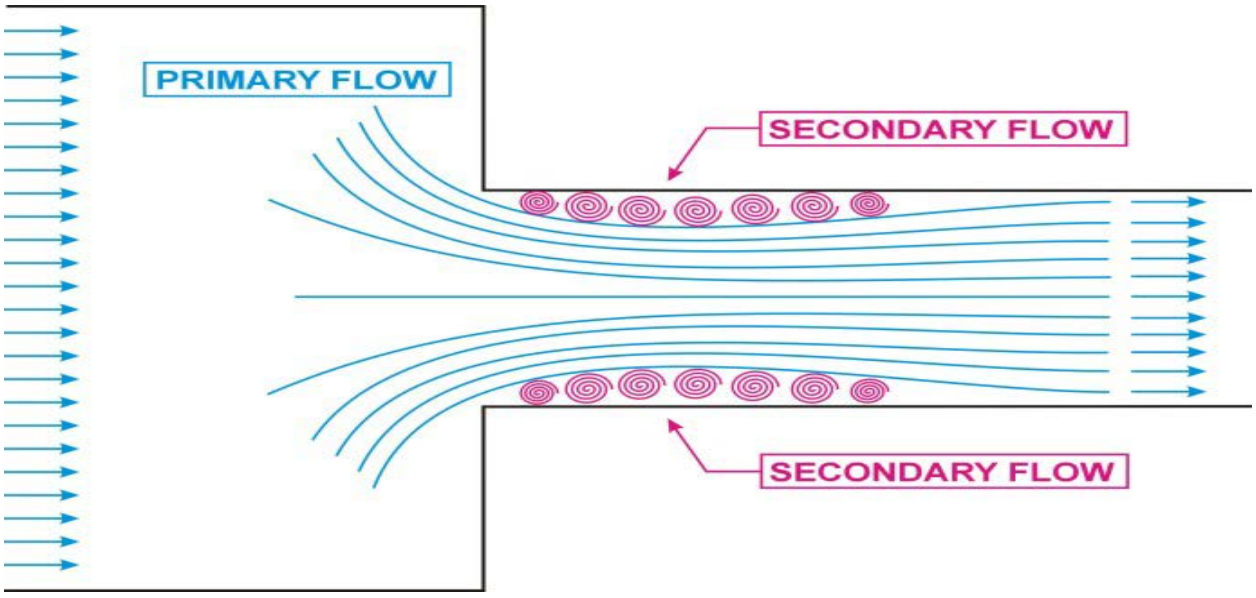


Figure 1. Flow Through a Culvert (FHWA 2007)

There are two common areas for scour holes to occur which are at the entrance of the culvert where the flow contracts and at the exit where flow expands. Inside the barrel of the culvert contraction scour occurs around the center of the channel.

During clear water conditions high velocities through the culvert result in the sediment inside the culvert to be lifted and carried downstream. As the sediment is carried from inside the culvert downstream, scour holes in the culvert are formed. This process increases the cross sectional area inside the culvert and decreases flow velocities. Velocities continue to decrease until the flow cannot carry sediment from inside the culvert and drop it downstream.

Laboratory experiments for estimating scour at bottomless culverts were conducted at the FHWA Hydraulics laboratory in Maryland. These laboratory experiments were used to help determine how deep footers would have to be for bottomless culverts to safely function. Local scour at the upstream corners of bottomless culverts is analogous to abutment scour at bridges. An analytical procedure has been developed that is based on estimating the local unit discharge in the vicinity of the culvert walls and predicting a local equilibrium flow depth needed to sustain that unit discharge. Secondary flows experience turbulence and mixing inside the culvert after the flow hits the corners of the abutments. Vortices are formed and scour is sometimes observed along the walls of the abutments (Arneson et al, 2012). Calculating the scour potential of these vortices can be very difficult and laborious, therefore experimental results were used to derive an amplification factor that accounts for vorticity and other secondary currents that are caused by sudden mixing at the upstream corners of the culvert.

Figure 2 shows the FHWA Hydraulics Laboratory. The FHWA in collaboration with the State of Maryland State Highway Administration funded this laboratory study and conducted numerous experiments that provided regulations and design guidance for consulting firms and municipalities across the country.

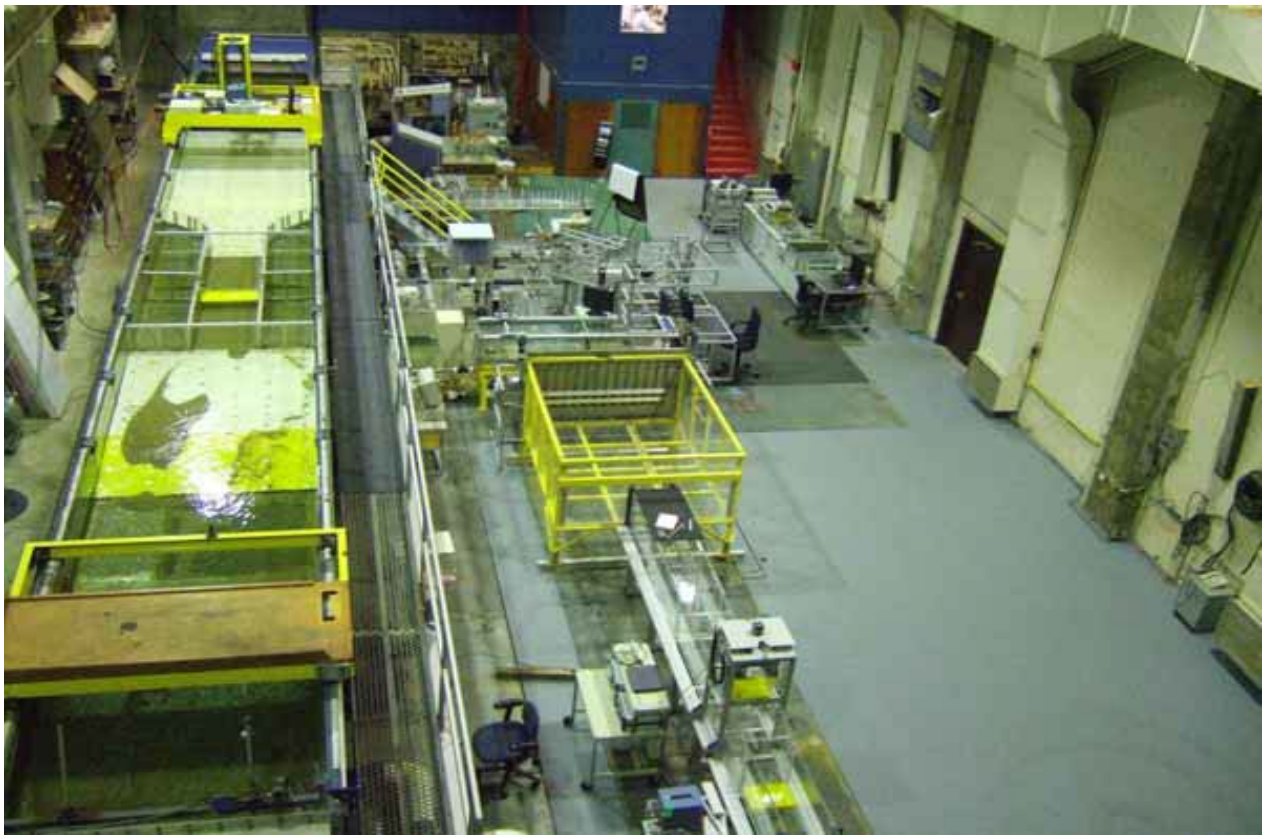


Figure 2. FHWA Laboratory (FHWA 2003)

These experiments were conducted in 6-foot wide tilting flumes in the FHWA Hydraulics Laboratory. Rectangular culvert shapes were tested for several flows at various velocities. Experiments included fixed bed as well as moveable bed tests. Entrance loss coefficients were calculated for pre-scour (fixed bed) and scoured (moveable bed) conditions based on pressure transducer measurements.

Rectangular culvert shapes were tested for fixed and moveable bed to determine entrance loss coefficients, velocity distributions inside the culvert, and maximum scour depths. Figure 3 shows a typical culvert model used to simulate bottomless culverts.

Figure 3. Culvert Model (FHWA 2003)

The culverts were installed in the test section of the 70-foot long flume, which were placed 39 feet from the upstream end of the flume. Silicon class pressure sensors were mounted in the centerline on the bottom of the experimental setup to measure instantaneous hydraulic grade lines. Time averages were taken for more precise loss coefficient computation. Discharges were provided by a 10 ft^3/s computer controlled pump. Flow depths and mean velocities were computed from pressure sensor measurements in the culvert barrel

flow that is parallel to the invert (Kerenyi et al, 2003). Particle Image Velocimetry (PIV) and/or velocity probes were used to augment these measurements in the highly turbulent region generated in the flow separation zone as the blocked flow mixes with the main channel flow at the upstream end of the culvert. PIV technology was used to measure instantaneous velocity flow fields. PIV utilizes a focused light source, a high-resolution digital camera, and sophisticated computer logic to trace particle movements. This technology makes it possible to accurately measure velocity in complex situations such as flow into culverts. Figure 4 shows the output from a PIV computer model.

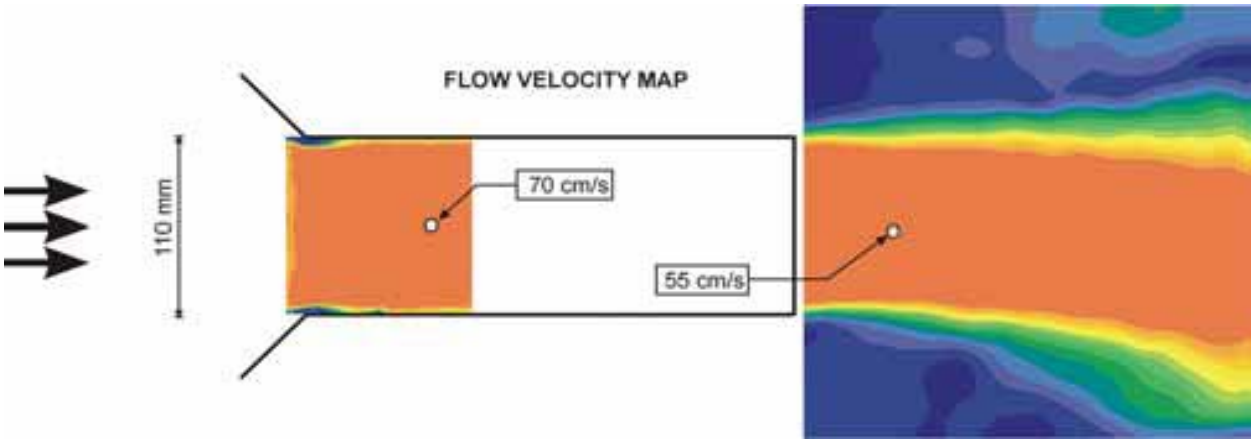


Figure 4. PIV Flow Velocity Map (FHWA 2007)

The experimental setup of a PIV system typically consists of several subsystems. In most applications tracer particles were added to the flow. These particles were illuminated in a plane of the flow at least twice within a short time interval. The light scattered by the particles was recorded either on a single frame or on a sequence of frames. The displacement of the particle images between the light pulses was determined through evaluation of the PIV

recordings. The local displacement vector for the images of the tracer particles of the first and second frame was determined by statistical methods (Kerenyi et al, 2007)

To simulate the pre-scour conditions, culvert entrance loss coefficients for fixed bed tests were derived. To simulate the scoured bed condition, culvert entrance loss coefficients for moveable bed tests were derived.

To check for validity and soundness, the experimental data was compared to the pre-scour velocity (V_R) assumptions made by CHANG and GKY. Initial assumptions were modified and new regression equations for the maximum depth of scour and for riprap design were derived as necessary. Experimental results were compared with scour depths and local velocities that were generated by numerical models (Kerenyi et al, 2007). Figure 5 shows a final scour map for one of the many modeling configurations used during experiments.

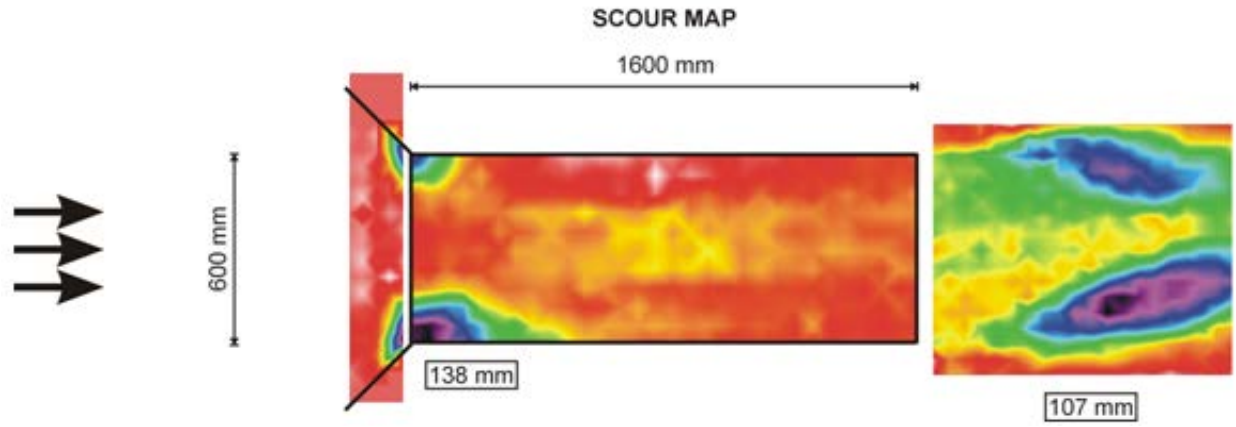


Figure 5. Scour Depth Map (FHWA 2007)

Several dozen physical modeling configurations were tested and the resulting scour was measured. The results were evaluated and predictive equations for estimating scour depth were developed. These equations were used as guidance for the design of footing

depths for bottomless culverts. Additional tests were conducted to determine the riprap sizes needed to prevent the deep scour that was observed near the upstream corners of the culvert when there is substantial approach flow blocked by the roadway embankments. These studies were strictly laboratory studies, there were no field studies conducted. Only clear-water condition equations were developed, there are no available techniques for estimating live-bed scour at bottomless culverts at this time. Pressure flow, long term degradation, and the effects of debris accumulation at the bridge were not accounted for in equations derived from this study.

The equations developed for estimating scour at bottomless culverts can be used to calculate the maximum scour depth for unsubmerged conditions. Two equations were developed using different variables, which would depend on the most readily available measurements and values. The first equation in based on V_{RA}, V_{CL}, *and* F_1. A step-by-step procedure is as follows:

Step 1: Compute the representative velocity of the flow using the average velocity in the approach section as follows.

$$V_{RA} = \frac{Q}{A_{CULV}} = \frac{Q}{y_0 w_{CULV}} \tag{1}$$

where:

V_{RA} is the representative local velocity at the entrance of the bridge.

Q is volumetric flow through the culvert (m^3/s).

y_0 is depth of flow in the approach to the culvert before scour (m).

w_{culv} is width of the culvert inlet (m).

Step 2: Express the critical velocity computed by Laursen's method in terms of y_2 as follows:

$$V_{CL} = 6.19 y_2^{1/6} D_{50}^{1/3} \quad (2)$$

where:

V_{CL} is the critical velocity at which incipient sediment motion occurs.

y_2 is the equilibrium flow depth (m).

D_{50} is the sediment size (m).

Step 3: Everything in the previous two equations should be known except for y_2. Now we can substitute the previous two equations into the following form.

$$y_2 = \frac{V_{RA} y_0}{V_{CL}} = \frac{Q y_0}{y_0 w_{CULV} (6.19 y_2^{1/6} D_{50}^{1/3})} \quad (3)$$

The expression can be rearranged to calculated y_2 as follows.

$$y_2 = \left[\frac{Q y_0}{6.19 y_0 w_{CULV} D_{50}^{1/3}} \right]^{6/7} \quad (4)$$

Step 4: Now use the following equation which was developed for computing maximum scour for bottomless culverts without wingwalls.

$$y_{max} = 2.2658 y_2 = 2.2658 \left[\frac{Q y_0}{6.19 y_0 w_{CULV} D_{50}^{1/3}} \right]^{6/7} \quad (5)$$

With wingwalls.

$$y_{max} = 1.7613 y_2 = 1.7613 \left[\frac{Q y_0}{6.19 y_0 w_{CULV} D_{50}^{1/3}} \right]^{6/7} \quad (6)$$

The second equation is based on using V_{RM}, V_{CN}, and $Q_{blocked}$. A step by step procedure is as follows:

Step 1: Compute the representative velocity of the flow using the calibrated velocity in the culvert inlet as follow.

$$V_{RM} = \left[1.024 \left(\frac{q_1}{q_2} \right)^{1.5} + 1.28 \right] \left[\frac{Q}{y_0 w_{CULV}} \right] \quad (7)$$

where:

Q is volumetric flow through the culvert (ft^3/s or m^3/s).

y_0 is depth of flow in the approach to the culvert before scour (ft or m).

w_{culv} is width of the culvert inlet (ft or m).

q_1 is unit discharge in the approach section (ft^2/s or m^2/s).

q_2 is unit discharge in the contracted section (ft^2/s or m^2/s).

The unit discharge ratio of q_1 divided by q_2 can be computed from the width ratio as follows.

$$\frac{q_1}{q_2} = \frac{w_{CULV}}{w_a} \tag{8}$$

where:

w_{culv} is the width of the bottomless culvert inlet (m).

w_a is the width of the approach section to the culvert (m).

Step 2: Express the critical velocity computed by Neill's method in terms of y_2. The equation for Neill's critical velocity is given as follows.

$$V_{CN} = K_{U1} 11.5 y_2^{\,x} D_{50}^{\,0.39} \tag{9}$$

The exponent, x, is calculated using the following equation:

$$x = K_{U2} \frac{0.123}{D_{50}^{\,0.20}} \tag{10}$$

where:

y_2 is the equilibrium flow depth, m or ft.

D_{50} is the sediment size, m or ft.

K_{U1} is $0.3048^{(0.65-x)}$ for SI units, or 1.0 for U.S. customary units.

x is the exponent in equation 9.

K_{U2} is 0.788 for SI units, or 1.0 for U.S. customary units.

Step 3: Everything in the previous equations should be known except for y_2. Now we can substitute the previous two equations into the following equation.

$$y_2 = \frac{V_{RM}\, y_0}{V_{CN}} = \frac{(1.024\,(q_1/q_2)^{1.5} + 1.28)\, Q\, y_0}{y_0\, w_{CULV}\, (11.5\, K_{U1}\, y_2^{\,x}\, D_{50}^{\,0.35})} \tag{11}$$

This expression can be rearranged to calculated y_2 as follows.

$$y_2 = \left[\frac{(1.024\,(q_1/q_2)^{1.5}+1.28)\,Q}{11.5\,K_{U1}\,w_{CULV}\,D_{50}{}^{0.35}}\right]^{(1/1+x)} \tag{12}$$

Step 4: Now use the following equation which was developed for computing maximum scour for bottomless culverts without wingwalls.

$$y_{max} = 1.5149\left(\frac{Q_{blocked}}{\sqrt{g}\,y_2{}^{5/2}}\right)^{0.0602}\left[\frac{(1.024\,(q_1/q_2)^{1.5}+1.28)\,Q}{11.5\,K_{U1}\,w_{CULV}\,D_{50}{}^{0.35}}\right]^{(1/1+x)} \tag{13}$$

With wingwalls.

$$y_{max} = 1.4456\left(\frac{Q_{blocked}}{\sqrt{g}\,y_2{}^{5/2}}\right)^{0.2332}\left[\frac{(1.024\,(q_1/q_2)^{1.5}+1.28)\,Q}{11.5\,K_{U1}\,w_{CULV}\,D_{50}{}^{0.35}}\right]^{(1/1+x)} \tag{14}$$

Figure 6 is a plot of y_{max} that was calculated using the regression equations derived from the laboratory experiments versus the measured y_{max}.

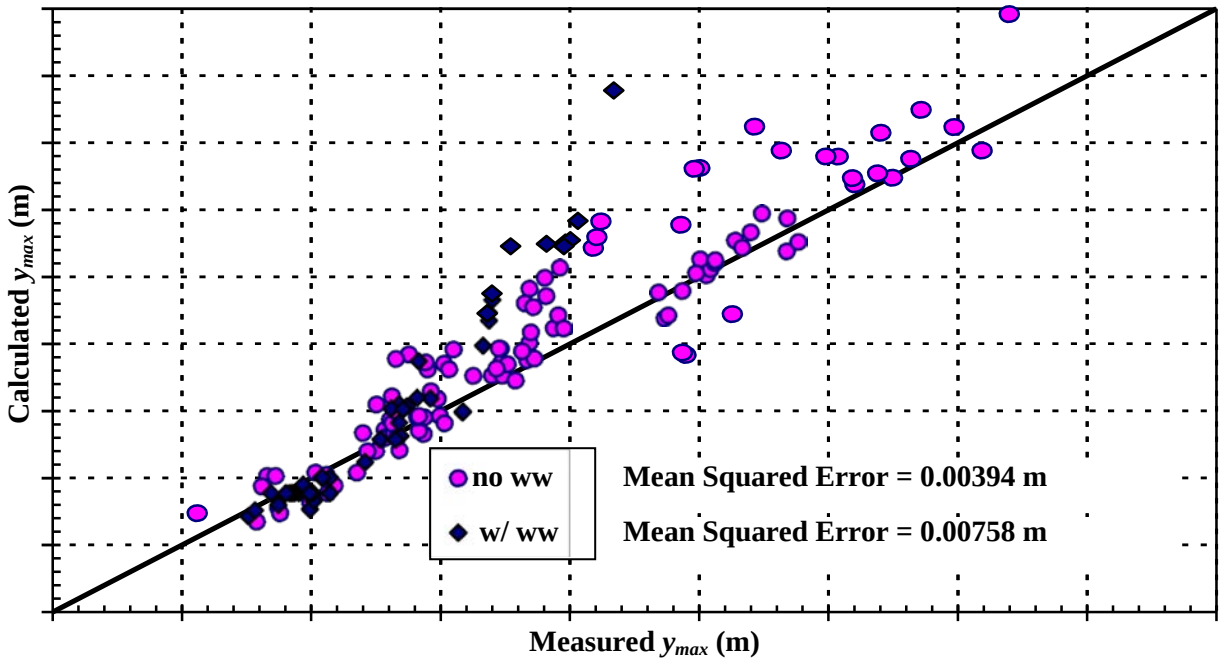


Figure 6. Validations of y_{max} as a function of V_{RA} and V_{CL} (FHWA 2007)

CHAPTER 3

METHODOLOGY

Given a sample size of over 20,000 bridges in the state of Kansas it was safe to assume there would be an abundant amount of data for this study. These bridges vary greatly in size and type. The largest of these bridges, multi-span bridges, usually have spread footer foundations that are keyed into bedrock or supported with piling that is driven to bedrock. The bridges that are neither multi-span nor do they have an integrated concrete floor were in a category called single span bridges and needed to be sorted out. It is important to use the correct type of bridge for this study and there were some variables that needed to be readily available for a comparison to be made. Some single spans have vertical walls with wings that are beveled at a 1:1 flare as their abutments, other did not have wing walls, for this study bridges with wing walls were needed.

The filtering process was done to ensure that the comparisons being made were not spurious. There was an abundant supply of bridges in Kansas that had the required data for a comparison; however, they had to be narrowed for a good comparison. First the multi-span bridges were filtered out because the laboratory tests were conducted on bridges that did not have piers. The addition of piers would require the tests to account for pier scour. Even though there are some bridges that resemble culverts that use the channel bottom as the floor, they were still excluded from this analysis. By removing the multi-span bridges the number of bridges was reduced from 20,367 bridges to 6,645 bridges. This number, 6,645, still included bridges that had an integrated concrete floor and was too large for a study to be conducted, therefore further filtering was required. The bridges that had a concrete floor, considered true culverts in the state of Kansas, were removed and the number of bridges was

reduced from 6,645 to 5,609. Since roughly 1,000 bridges were removed with the last filtering process, the remaining number of bridges was too large for a field study to be conducted. The next stage in the filtering process entailed finding bridges that most resembled the bridge models used in the FHWA laboratory study. The FHWA received designs from major manufacturers of single-span bridges that make their bridges out of concrete. The models did not have any piles on the abutment walls under the bridge. In order to more accurately represent these, the bridges were filtered to exclude all bridge that was made out of timber or steel. Some of the timber and steel bridges constructed in Kansas have piles along the abutment under the bridge for support of the abutment against earth pressures. These piles were not taken into account in the laboratory study and may or may not affect the scour depth calculations. For greater comparative accuracy the bridges used were concrete. This filtering process reduced the number of bridges from 5,609 to 1,375. The remaining 1,375 bridges were as close to the model bridges used in the laboratory as possible. Preparing a proper field study for over 1,000 bridges would take too long; therefore certain counties were chosen. Some counties had better field data than others and the counties that had the best records were used for this analysis. Also there were some counties that have no recorded scour at bottomless culverts, either because the bridges were fairly new or due to the lack of flood events that cause scour. Some of the streams that run through these bridges are ephemeral therefore scour did not occur. Bridges in the following counties were used for this analysis: Butler, Ford, Geary, Jewell, Lyon, Marion, McPherson, Miami, Morris, and Osborne. Having completed this filtering process the number of bridges was reduced from 1,375 to 198. The available documentation, such as Structure Inventory and Appraisal (SI&A) sheets, biennial inspection records, historic photos, field measurements, and current

photos, were reviewed to determine which bridges were best fit for this analysis. Out of the 198 remaining bridges about 32 were selected for an in-depth scour analysis. After thorough review of the 32 bridges 25 final bridges were chosen and used for the comparison. Table 1 shows the information of the bridges used for the analysis.

Table 1 – Bridge Information

Structure #	Measured Scour (ft)	D_{50} (ft)	Width (ft)	y_0 (ft)
000570831005209	2.00	0.083	22.00	2.47
000710687003880	2.00	0.083	20.00	2.59
000390737606760	2.50	0.083	20.00	2.94
000080863405720	2.50	0.167	24.00	3.00
000560941805520	2.00	0.083	24.90	3.38
000590809805020	2.00	0.083	26.90	3.73
000450733503100	3.00	0.083	24.90	4.00
000080889005844	4.00	0.042	30.80	4.00
000080891606268	2.00	0.083	25.90	4.46
000640917004864	2.00	0.167	39.00	4.58
000080865806460	2.50	0.042	21.00	5.00
000640879504966	3.00	0.083	38.10	5.13
000310901804505	2.00	0.167	39.00	5.30
000640889204800	2.00	0.083	37.10	5.31
000590759004940	2.00	0.083	39.00	5.41
000570859305387	2.00	0.333	41.00	5.58
000450731003104	3.50	0.083	27.90	5.64
000590793105020	2.00	0.083	21.00	5.90
000290545005901	2.00	0.083	24.90	5.93
000640915904880	3.00	0.167	30.00	6.00
000611067405000	3.00	0.167	26.00	6.59
000080857805880	4.00	0.125	30.00	7.00
000080883006004	3.00	0.083	32.20	7.50
000080891005740	3.00	0.167	46.90	8.00
000080875006464	5.00	0.042	33.00	8.00

Each bridge used had record of some level of scour at the abutments, inlets, or outlets. The maximum scour depth recorded at any of these locations was used in the analysis. The field measurements were taken with standard scour measurement equipment as shown in the sample pictures shown in Figure 7.

Figure 7 – Standard Scour Measurement Tool

Some of the bridges did not have a photograph of the actual scour depth but all scour depths used in the analysis were measured and documented by certified KDOT bridge inspectors. The scour depths measured were compared to calculated scour depths. The empirical equations derived by the FHWA following their laboratory studies were used to calculate maximum scour depths. Equations were placed in a spreadsheet and values were

input for each bridge and compared with measured values. The computation required the use of HY-8 to model the bridge for required values. Using HY-8 required some field parameters to determine the flow through the culvert. High water marks observed at the site were used to determine a height of water at the bridge and then to back out the flow rate. The type of sediment in the channel was recorded by field personnel. The bridge dimensions were taken from the SI&A sheets. Manning's n values were estimated for the site given the channel bed material and site specific conditions. The Manning's n value used through the bridge was the same as the channel Manning's n value since the bottom of the culvert is the channel bottom.

The calculated scour depths were placed in a table along with field measurements for comparison. The table was used to create a graph with a line of perfect agreement between the two values to determine how close together or far apart they were. To determine areas of possible improvements, the graphs were manipulated for certain parameters to find the possible reasons for agreement or disagreement between values.

3.1 Step by Step Example

The process used to calculate the maximum scour depth at bottomless culverts is shown below. One bridge from the final 25 was chosen to demonstrate how the final values for the bridges were determined. Bridge # 000080863405720 was chosen to show how the results were found, and a step by step procedure is as follows:

Step 1 - Finding measured scour.

The measured scour at this bridge was recorded as 2.5 feet at the front end of the abutment. The scour found in the laboratory was consistently greatest at the entrance to the culverts. This shows that there is agreement between the location of scour in the field and in the laboratory in this case. The measurements were taken by certified bridge inspectors using

standard equipment. Waders were used to get into the water and probe around the abutment to determine the maximum scour depth. The probe was marked by alternating colors each 1 foot apart.

Step 2 - Finding Parameters for Calculations.

The Structure Inventory and Appraisal (SI&A) sheets were used to find year built and the bridge dimensions. The SI&A for this bridge is available in the appendix with photos and detailed scour calculations.

This bridge was built in 1915 and is 24 feet wide. The other parameters needed are the channel bed material, Manning's n value, and the flow rate through the culvert. The channel bed material was recorded by field personnel to be boulders and cobbles. In Julian's book Erosion and Sedimentation, boulders and cobbles are estimated to have a D_{50} sediment size of about 2 inches (Julian, P.Y., 2010). The Manning's in value used for a channel with boulders and cobbles was estimated to be 0.035 according to guidance provided by Chaudhry's Open Channel Flow book (Chaudhry, H.M., 2008). The flow rate through the culvert was calculated using HY-8, which requires the depth of flow in the approach section of the culvert before scour. This was estimated to be about 3 feet for this bridge after reviewing all of the available pictures and finding a high water mark on the bridge abutments. Using the available parameters the flow rate was determined to be 317 ft^3/s through the culvert. The equations provided at the end of the FHWA Phase II laboratory report were used to determine V_{RA}, V_{CL}, y_2, and y_{max}, which were 4.35 ft/s, 6.87 ft/s. 0.58 feet, and 3.35 feet respectively. This bridge had wingwalls at the entrance that were beveled therefore the equation for bottomless culvert with wingwalls was used.

Step 3 - Comparing results.

The measured scour at the culvert was 2.5 feet and the calculated scour was 3.35 ft. The measured and calculated scours were both observed at the entrance of the culvert as the flow contracts.

CHAPTER 4

RESULTS

Scour observed in the field was similar to the scour observed in the laboratory in terms of location of scour with respect to the bridge. In some cases the maximum scour in the field occurred inside the culvert, while the laboratory maximum scour was consistently found at the inlet and outlet. The laboratory study scour equations were developed only for the corners of the upstream section of the culvert. When the scour observed in the field was along the interior wall of the culvert, it was deeper on one wall than the other. The channel bottom used in the laboratory was sand, while majority of the channel bottoms at the culverts used in this study had a combination of silt, clay, sand, and gravel. The age of the culverts used in the study varied from 40 to 100 years old. Given this range of ages the median flow rate through majority of these culverts is not well documented nor easily calculated. The depth of scour found at the bridges was generally lower than the maximum scour calculated using the equations derived from the laboratory studies. There were a few cases that were close and would have been a great estimate for design, but majority were overestimated. The results were much closer and more consistent than any previous bottomless culvert scour calculations, which makes these equations the best available.

All of the culverts found in the field had a lower measured than calculated scour depths. There were four culverts that were close to the line of perfect agreement between the measured and calculated scour depth, as shown in Figure 8.

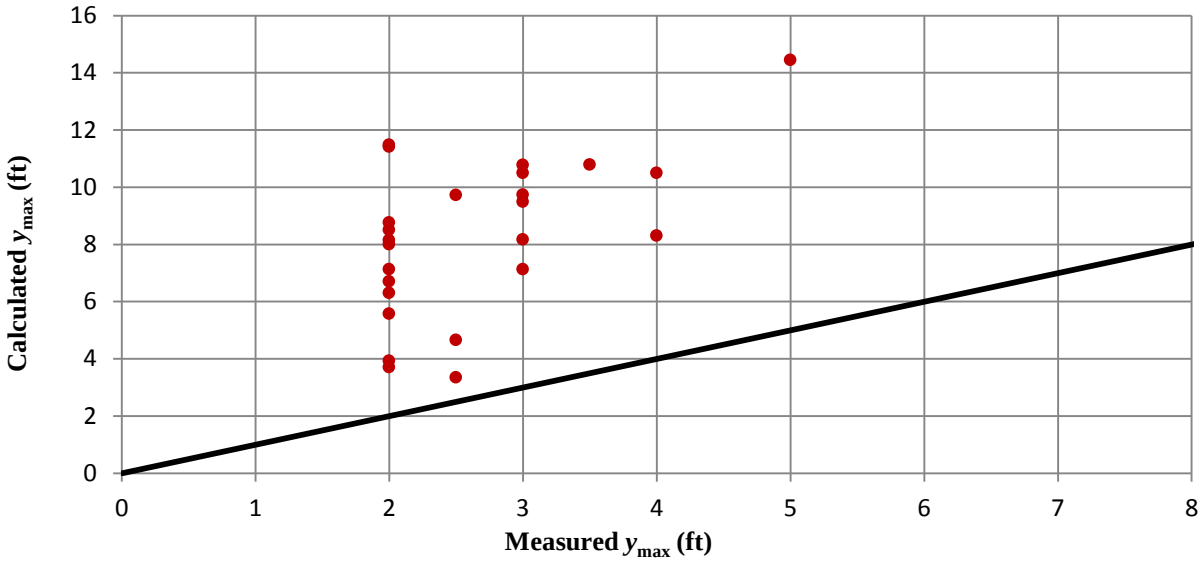


Figure 8 – Measured vs. Calculated Scour Depth

A couple of the bottomless culverts had a difference of 9 feet or more, with an average difference of 5.65 feet between the measured and calculated scour depths. None of the culverts used in the analysis were lower than the line of perfect agreement, however compared to the gross over-estimation of abutment scour equations the equations derived during these studies are a step in the right direction.

The location of the scour holes found in the field was similar to the location of the scour holes in the laboratory. The laboratory studies indicated that the equations derived were only for estimating the scour at the corners of the entrance of the culvert. In the field the location was also at the corner of the culvert with the exception of one bridge that had a scour hole in the interior wall of the culvert that was deeper than the hole in the upstream corner of the bridge which may have been due to the skew of the bridge to the flow. The flow may have been missing the entrance corner and was against the abutment interior wall causing the most turbulence as the water was crashing against the wall causing scour.

The calculations for each individual bridge using both methods derived from the laboratory studies can be found in the appendix, a summary of the results is shown in Table 2.

Table 2 – Calculated and Measured Scour Depths

Structure #	Measured Scour (ft)	Calculated Scour (ft)	D_{50} (ft)	Width (ft)	y_0 (ft)
000590793105020	2.00	11.41	0.083	21.00	5.90
000611067405000	3.00	10.78	0.167	26.00	6.59
000080875006464	5.00	14.45	0.042	33.00	8.00
000290545005901	2.00	11.48	0.083	24.90	5.93
000080865806460	2.50	9.73	0.042	21.00	5.00
000080857805880	4.00	10.50	0.125	30.00	7.00
000080883006004	3.00	10.50	0.083	32.20	7.50
000450731003104	3.50	10.79	0.083	27.90	5.64
000640915904880	3.00	9.74	0.167	30.00	6.00
000080891606268	2.00	8.00	0.083	25.90	4.46
000080891005740	3.00	8.17	0.167	46.90	8.00
000450733503100	3.00	7.13	0.083	24.90	4.00
000390737606760	2.50	4.66	0.083	20.00	2.94
000640889204800	2.00	8.51	0.083	37.10	5.31
000590759004940	2.00	8.76	0.083	39.00	5.41
000590809805020	2.00	6.30	0.083	26.90	3.73
000570859305387	2.00	7.13	0.333	41.00	5.58
000310901804505	2.00	8.15	0.167	39.00	5.30
000560941805520	2.00	5.58	0.083	24.90	3.38
000640879504966	3.00	9.49	0.083	38.10	5.13
000080889005844	4.00	8.30	0.042	30.80	4.00
000710687003880	2.00	3.93	0.083	20.00	2.59
000080863405720	2.50	3.35	0.167	24.00	3.00
000640917004864	2.00	6.70	0.167	39.00	4.58
000570831005209	2.00	3.71	0.083	22.00	2.47

The table shows the difference in the values that range from less than a foot to over 9 feet. Given the complicated nature of these structures and the possible variability in the hydraulics these results are promising. Some minor changes were made to the results in an effort to isolate the likely reason for the difference between calculated and measured values. Table 3 shows the results.

Table 3 – Variable Isolation Results

	Maximum (ft)	Minimum (ft)	Average (ft)	Std. Dev
All Data	9.41	0.85	5.65	4.28
Low d/w Ratio	6.76	0.85	4.20	2.96
Non-Cohesive	7.78	0.85	5.38	3.47

The bridges found the field that closely resembled the models used in the laboratory had better results than the bridges that deviated from the bridges used in the laboratory. A graph representing the bridges that had non-cohesive soils is shown in Figure 9.

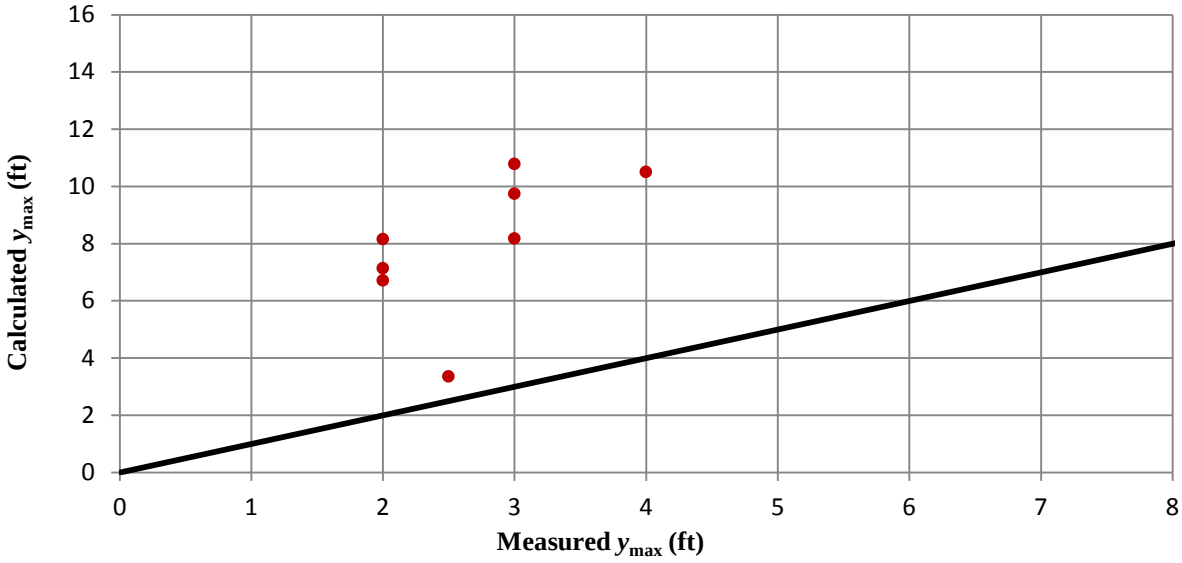


Figure 9 – Graph Measured vs. Calculated Scour for Non-Cohesive Soils

The elimination of some of the highly varied results can be seen when comparing Figure 8 to Figure 7. The results are closer to the line of prefect agreement and the table that the standard deviation is lower. The final graph shown in Figure 10 shows the bridges with low height to width ratios.

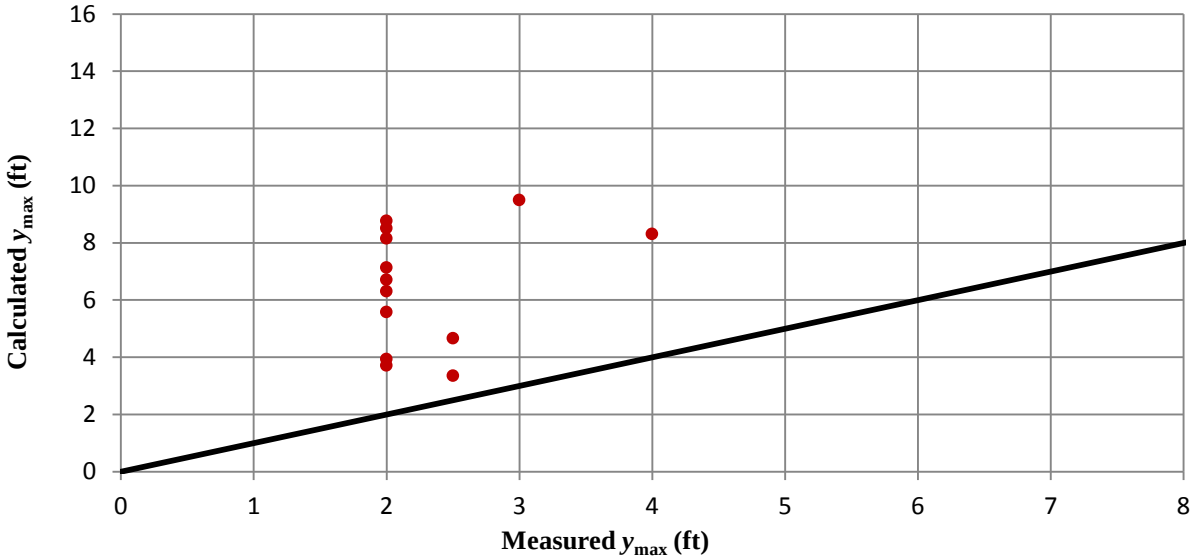


Figure 10 – Graph Measured vs. Calculated Scour with Low Height to Width Ratios

The graph shows that there are more bridges in the subset that have similar height to width ratios than non-cohesive soils. The standard deviation of the group of bridge is the lowest. The maximum difference between the calculated and measured scour depth is just under 7 feet. There is a 30% reduction in the maximum scour depth calculated for this subset of bridges.

CHAPTER 5

DISCUSSIONS

The river environment is a very dynamic environment and trying to create a simulated and controlled experiment that mimics the natural stream is very challenging. The variables that may have caused the differences between the field and laboratory studies are many. The real world examples of the streams found in the laboratory studies are few and far between. The laboratory used straight flowing streams that had sand bends with the flow running at a certain rate for a specified amount of time. This is very difficult to find in the natural world. In most cases it is not known which event or series of events caused the scour depths observed in the field. Getting the correct hydrologic and hydraulic variables necessary for complete and accurate calculations is often a daunting task and there can be a lot of variability in the results based on the parameters used. Assuming conservative variables was common practice in the research and calculations of this report. We can speculate as what is likely the cause of such depths and the following is an attempt to analyze the differences between the field and laboratory data found in this report.

Some of the scour holes found in the field were at the abutment interior walls. This is likely an indication that the flow coming into the culvert was skewed causing more flow and higher velocities at one wall than the other. These types of bridges were avoided due to the laboratory experiments specifying that the equations derived were only applicable to scour holes found at the corners of the entrance to the bridge.

Due to the old age of many of these bridges, there are some factors that were accounted for that may not be completely accurate. One possible inaccuracy that may have affected the results in this report is that some of the older bridges may have been rehabilitated

and their high water marks and the scour observed may not be the maximum observed at the site. Other possibilities include countermeasures placed that were not documented well and may have washed away. If this occurred then the measured scour at the site is likely to be much lower than the actual scour if the countermeasures were not placed at some time during the life of the bridge. Debris accumulation and removal during the life of the bridge would also have such an effect of the results. The effects of debris on bottomless culverts were neither taken into account in the laboratory studies nor in the results of this report. Degradation is likely to occur at many of these locations since the life of these bridges has been so long, the stream may have gone through more than one stage in the evolutionary process, so it may have been aggrading for a period and is now degrading or vice versa. Degradation was not taken into account in the FHWA laboratory studies.

The gap between calculated and measured scour depth is likely linked to the cohesive factor of the soils. Cohesive soils have a chemical bond that non-cohesive soils lack, therefore it would take a higher velocity of flow to pull cohesive soil particles apart. The equations used in this analysis do take into account the size of the soil particles but they do not account for different types of soils. Cohesive soils tend to scour in chunks rather than in single particles like non-cohesive soils. The bond between the cohesive particles is not always the same therefore the weakest bond will break and it is not always be the bond of the top particles. The weight of the chunk also makes it more difficult to move. Figure 9 shows the bridges with non-cohesive soils. This bed material resembles the sand beds that were used in the laboratory.

Figure 9 shows that the cohesive soils contributed to the variance between the measured and calculated scour depths. The average difference for this group of bridges was

5.38 feet compared to an average difference of 5.65 feet for the all bridges considered in this study.

The difference in the bridge's width and height ratio seemed to play a part in the variance between measured and calculated scour depths. Bridges that had the closest width to height ratios to the laboratory bridges had the smallest difference in measured and calculated scour depths. The bridges used in the laboratory were rectangular, with the span of the bridge being larger than the height.

The bridges in the field that were square, or closer to squares than rectangles, had a large difference between calculated and measured scour depth. This is likely due to the difference in the height of flow coming into the culvert. Figure 10 is a graph of the bridges with a low width to height ratio.

The graph shows that the largest gaps between the measured and calculated scour depths occur when the width to height ratio was deviated from 2.5. The equations used to calculate the scour depths are driven by the depth of the water coming into the culvert before scour; therefore they are sensitive to changes to y_0. Bottomless culverts with a width to height ratio that was near 2.5 were closer to the line of perfect agreement as shown in the graph in Figure 10. The average difference between this group of bridges was 4.20 feet compared to 5.65 feet for all of the bridges.

This may be an indication that the difference in pressure between head waters above and below the width to height ratio of 2.5 do not increase or decrease as the equation outputs do. A combination of low head water and non-cohesive particles yields the smallest difference between the measured and calculated scour depths, as in bridge number 00080863405720. This bridge closely resembles the bridges used in the laboratory studies

and therefore has an insignificant difference between the measured and calculated scour depths. The location of scour at this bridge is also at the entrance to the culvert, which matches the location of scour in the laboratory.

CHAPTER 6

CONCLUSIONS

The laboratory studies conducted by the FHWA are the best available to date. The existing equations that would be used for bottomless culverts would likely have been the abutment scour equations, which overestimate the scour potential. The equations developed by the FHWA were more reasonable and yielded scour depths that could be feasibly designed They are similar in quality and quantity, the measured and calculated depths were closer to measured depths found in the field and the location of scour in the field and laboratory were the same. The likelihood of these equations being used by engineering firms and municipalities across the country is greater than the existing abutment scour equations. Bottomless culvert equations are an improvement from abutment scour equations.

Given that the likely difference between the field and laboratory studies was the cohesive nature of the soil and the width to height ratio of the bridge, the bottomless culvert equations can be used with reasonable accuracy for soils that are non-cohesive and for low head water conditions. The field scour depths found in this report represent typical occurrences. In the Kansas scour evaluation program it was rare to find scour depths that greatly undermined the abutment of the bottomless culverts, which may be an indicator that the current methods are acceptable but may need more data to show designers how to better design safer bottomless culverts. The use of the FHWA study will likely provide that guidance and in most cases only require the depth of the footings for these bridges to be slightly deeper, safer and economical.

An adjustment factor can possibly fix the overestimated scour potential by lowering the calculated depth of scour depending on the strength of the bond between the soil particles

and by making bridges wider with less head water. Arch bridges may be good candidates since they are usually wider than they are tall. This study has defined the required information for creating robust data sets to develop and verify scour equations for bottomless culverts. Future studies will likely yield better results and may not require adjustment factors.

The factors that may have affected the gap between the results will require further investigation and research to determine how they can be addressed and minimized. They can be; the size of the particles, the flow quantity and depth, the height to width ratio, degradation and aggradation, human interference, upstream conditions, number of events affecting the bridge throughout its life, and bridge alignment to the flow. Considering some of these factors, such as degradation and debris accumulation, would likely decrease the difference in values between measured and calculated scour depths. There is a certain level of uncertainty when it comes to some of the hydraulic variables, such as flow rates and high water marks, that were assumed or calculated based on available data.

CHAPTER 7

FUTURE WORK

The following aspects were not considered in this study and may provide further insight into bottomless culvert studies. Only unsubmerged conditions were evaluated in this study, the bridges found and used did not have any indication of frequent overtopping. Submerged conditions would have to take pressure flow into consideration which was not done in this report. The head water would be more difficult to estimate given that the high water mark would have to be found somewhere other than the interior walls of the bridge. Live bed conditions were not considered in this study only clear water. It was assumed that the water coming into the culvert was not carrying sediment, which was the case with the laboratory studies also. All bridges considered in this study had wing walls. Bridges with and without wing walls were tested in the laboratory study and equation were derived for both cases. Also as the project progresses into the western part of Kansas, which is known for having alluvial non-cohesive bed material, it is likely to give more bridges that show signs and scour and would make great samples for further studies on bottomless culverts. There is a need for a larger subset of bridges to make the study more comprehensive. The subset used for this study was sufficient for an initial step into the realm of field verification but it would be interesting to see what more bridges would tell.

The conditions in the field that caused the scour at the culverts were not apparent. It may have been a single event or a series of events that caused the measured scour depth. The flow into the culvert, the height of water, the duration of the event, and the number of events is unknown. The parameters used were the most readily available and the most likely indicators of field conditions. The bridges used may have had larger scour holes but were

either filled in and compacted over time or fixed by city maintenance crews sometime in the life of the culvert. Long term degradation or aggradation was not taken into account in this study. Some of the high water marks found in the field may have been made at a time when the channel bed was higher if the stream is degrading or lower if the stream is aggrading. The effects of drift accumulation, or trash dumped into the stream were not taken into consideration. Sometimes the presence of trash or drift can accentuate the effects of scour on a culvert, therefore if the debris was present and later cleaned it may change the values of the scour depths. If the culvert was skewed to the flow the depth and location of scour may be affected. There are many cases in the field where the bridge is built well aligned and over time the river begins to meander and cause a skew. It was assumed in this study that the flow coming into the culvert had a slight skew at best. The laboratory studies had a perfectly straight channel that may have caused some of the differences in values.

Future laboratory studies should include different depth to width ratios, for example narrow bridge with high flow to see how the scour would change. There are bridges in the field that are narrow and have steep banks therefore this type of configuration should be tested. Testing pressure flow conditions without overtopping, also called vertical contraction, would be recommended. Many of the streams found in the field have skewed flow and testing skewed flow in the laboratory may show some different scour hole locations and depths. Live bed conditions are also recommended for laboratory testing due to the existence for sediment in many large rivers across the country.

Some of the shortcomings that became evident late in this study include having a larger subset of bridges. Although 25 bridges were a start, future studies should have more bridges to test for possible causes of differences between field and laboratory and having

conclusive results that support or oppose assumptions. It may be advantageous to make a second pass at the counties and bridges already studied may find more data that was missed the first time. In the near future other states may be required to conduct the same bridge updating program as Kansas, making other state bridges available for review and expanding the data set to more diverse types of soils and bridges. If these recommendations are considered and implemented, it is likely that improved equations can be derived based on field and laboratory data.

APPENDIX

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000080857805880**	(1) STATE	**Kansas**	(4) CITY	**Rural**	(3) COUNTY	**Butler**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			GILLION CREEK
(9) LOCATION			1.8E 2.0S OF POTWIN
(16) LATITUDE			37 ° 54 ' 43.19 "
(17) LONGITUDE			96 ° 59 ' 25.21 "
(2) HIGHWAY AGENCY DISTRICT			Hutchinson
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL 4N8-25-4

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	50
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2011
(27) YEAR BUILT	1917
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	1-lane Br for 2-way
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	1
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	1.900 MI

LOAD RATING

(66) INVENTORY LOAD RATING	18 ton, HS 9.00
(64) MAXIMUM LOAD RATING	30 ton, HS 16.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	10.0-19.9%below
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			01/22/2011
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Repl-Load Capacity
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	82.00 FT
(94) BRIDGE COST	$180000
(95) ROADWAY COST	$70000
(96) TOTAL COST	$370000
(97) COST ESTIMATE YEAR	2011
(114) FUTURE ADT	50
(115) FUTURE ADT YEAR	2031

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	33.1 FT
(48) MAXIMUM SPAN LENGTH	29.9 FT
(32) ROUTE WIDTH	18.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	15.8 FT
(52) DECK WIDTH OUT TO OUT	18.0 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	15.4 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	3

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	4
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	8
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	61.60
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

View across the bridge to the west

Profile view of the bridge to the north

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} is sediment size

Inputs		Conversion (ft)	Outputs		Conversion (ft)			
Q (m^3/s) =	38.14	1362	V_{RA} (m/s) =	1.95	6.40	y_{max} (m) =	4.11	Without wingwalls
y_0 (m) =	2.135	7	A_{culv} (m^2) =	19.54	210.28	y_{max} (m) =	3.19	With wingwalls
w_{culv} (m) =	9.15	30	V_{CL} (m/s) =	2.30	7.54	Conversion (ft)		
D_{50} (m) =	0.0381	0.125	y_2 (m) =	1.81	5.94	y_{max} (ft) =	13.47	Without wingwalls
						y_{max} (ft) =	10.47	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1362
y_0 (ft) =	8
w_{culv} (ft) =	30
w_a (ft) =	40
D_{50} (ft) =	0.125

Outputs	
V_{RM} (ft/s) =	7.34
A_{culv} (ft^2) =	240
V_{CN} (ft/s) =	8.05
y_2 (ft) =	7.30
q_1/q_2 =	0.75
x =	0.186

y_{max} (ft) =	11.06	Without wingwalls
y_{max} (ft) =	10.55	With wingwalls

Built = 1917

Bridge # = 000080857805880

Channel Bottom= Boulders and Cobbles

Measured Scour (ft) = 4

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
200.00	148.16	1.66	1.37	1.78	3-M2t	6.49	0.91	1.52	1.51	3.26	3.30
400.00	299.14	2.56	2.18	2.74	3-M2t	10.00	1.46	2.33	2.33	4.28	4.29
600.00	450.42	3.30	2.86	3.55	3-M2t	10.00	1.92	3.01	3.01	4.99	4.99
800.00	601.87	3.97	3.47	4.27	3-M2t	10.00	2.33	3.61	3.61	5.55	5.54
1000.00	753.74	4.58	4.03	4.93	3-M2t	10.00	2.70	4.17	4.17	6.03	6.00
1200.00	905.66	5.15	4.56	5.55	3-M2t	10.00	3.05	4.69	4.69	6.43	6.40
1400.00	1057.69	5.69	5.06	6.13	3-M2t	10.00	3.39	5.19	5.19	6.80	6.75
1600.00	1210.61	6.21	5.56	6.70	3-M2t	10.00	3.71	5.66	5.66	7.13	7.07
1800.00	1362.71	6.71	6.05	7.23	3-M2t	10.00	4.01	6.12	6.12	7.42	7.36
2000.00	1515.79	7.19	6.52	7.76	3-M2t	10.00	4.31	6.56	6.56	7.70	7.62

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000080863405720**	(1) STATE	**Kansas**	(4) CITY	**Rural**	(3) COUNTY	**Butler**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Rehabilitation**

IDENTIFICATION

(5B) ROUTE TYPE	County Hwy
(5C) SERVICE TYPE	Mainline
(5D) ROUTE NUMBER 00000	(5E) SUFFIX N/A (NBI)
(6A) FEATURE INTERSECTED	E. BR. WHITEWATER RIVER
(9) LOCATION	3.0W 4.0S OF BURNS
(16) LATITUDE	38 ° 01 ' 40.70 "
(17) LONGITUDE	96 ° 56 ' 38.80 "
(2) HIGHWAY AGENCY DISTRICT	Hutchinson
(98A) BORDER BRIDGE STATE	Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY	%
(99) BORDER BRIDGE STRUCTURE NO.	_
(7) (ROUTE NAME) FACILITY CARRIED	LOCAL 25N4-23-4

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	50
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2004
(27) YEAR BUILT	1915
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	1.900 MI

LOAD RATING

(66) INVENTORY LOAD RATING	18 ton, HS 9.00
(64) MAXIMUM LOAD RATING	30 ton, HS 16.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			01/28/2011
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Repl-Load Capacity
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	82.00 FT
(94) BRIDGE COST	$180000
(95) ROADWAY COST	$40000
(96) TOTAL COST	$350000
(97) COST ESTIMATE YEAR	2009
(114) FUTURE ADT	50
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	25.9 FT
(48) MAXIMUM SPAN LENGTH	24.0 FT
(32) ROUTE WIDTH	18.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	16.1 FT
(52) DECK WIDTH OUT TO OUT	17.4 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	15.8 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	5
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Functionally Obsolete
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	5
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	3
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	51.30
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

View across the bridge to the east

Profile view of the bridge to the south

METHOD 1

Q is volumetric flow through the culvert
y_0 is depth of flow in the approach to the culvert before scour
w_{culv} is width of the culvert inlet
y_2 is equillibrium flow depth
D_{50} is sediment size

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	8.88	317	V_{RA} (m/s) =	1.33	4.35
y_0 (m) =	0.915	3	A_{culv} (m^2) =	6.70	72.10
w_{culv} (m) =	7.32	24	V_{CL} (m/s) =	2.09	6.87
D_{50} (m) =	0.0508	0.167	y_2 (m) =	0.58	1.90

y_{max} (m) =	1.31	Without wingwalls
y_{max} (m) =	1.02	With wingwalls
Conversion (ft)		
y_{max} (ft) =	4.30	Without wingwalls
y_{max} (ft) =	3.35	With wingwalls

METHOD 2

Q is volumetric flow through the culvert
y_0 is depth of flow in the approach to the culvert before scour
w_{culv} is width of the culvert inlet
q_1 is unit discharge in the approach section
q_2 is unit discharge in the contracted section
w_{culv} is width of the bottomless culvert inlet
w_a is width of the approach section to the culvert
y_2 is equillibrium flow depth
D_{50} is sediment size
K_{UI} is 1.0 for U.S. customary units
K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	317
y_0 (ft) =	3
w_{culv} (ft) =	24
w_a (ft) =	30
D_{50} (ft) =	0.167

Outputs	
V_{RM} (ft/s) =	5.79
A_{culv} (ft^2) =	72
V_{CN} (ft/s) =	7.18
y_2 (ft) =	2.42
q_1/q_2 =	0.80
x =	0.176

y_{max} (ft) =	3.67	Without wingwalls
y_{max} (ft) =	3.50	With wingwalls

Built = 1915
Bridge # = 000080863405720
Channel Bottom= Boulders and Cobbles
Measured Scour (ft) = 2.5

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
80.00	63.13	1.21	0.90	1.33	3-M2t	4.00	0.60	1.20	1.20	2.19	2.78
160.00	127.87	1.87	1.43	2.05	3-M2t	4.00	0.96	1.85	1.85	2.88	3.60
240.00	194.11	2.43	1.89	2.65	3-M2t	4.00	1.27	2.40	2.40	3.37	4.17
320.00	240.27	2.94	2.19	3.15	3-M2t	4.00	1.46	2.89	2.89	3.46	4.62
400.00	261.20	3.51	2.33	3.57	3-M2t	4.00	1.55	3.34	3.34	3.25	4.98
480.00	285.86	4.06	2.48	3.98	3-M2t	4.00	1.64	3.77	3.77	3.16	5.30
560.00	311.21	4.59	2.63	4.42	4-FFf	4.00	1.74	4.00	4.18	3.24	5.59
576.00	316.98	4.70	2.67	4.51	4-FFf	4.00	1.76	4.00	4.26	3.30	5.64
720.00	393.95	5.47	3.12	5.34	4-FFf	4.00	2.03	4.00	4.95	4.10	6.06
800.00	439.24	5.87	3.37	5.81	4-FFf	4.00	2.19	4.00	5.32	4.58	6.27

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000080865806460**	(1) STATE	**Kansas**	(4) CITY	**Rural**	(3) COUNTY	**Butler**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			CHIGGER CREEK
(9) LOCATION			2.2W 2.0S OF SMILEYBERG
(16) LATITUDE			37 ° 29 ' 25.23 "
(17) LONGITUDE			96 ° 55 ' 17.01 "
(2) HIGHWAY AGENCY DISTRICT			Hutchinson
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL 31N8-29-5

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION			Rural Local
(104) NHS DESIGNATION			Not on NHS
(100) STRAHNET DESIGNATION			Not a STRAHNET hwy
(110) NATIONAL TRUCK NET			Not part of natl netwo
(12) BASE HIGHWAY NET			Not on Base Network
(13A) LRS INVENTORY ROUTE		(13B) LRS SUBRTE #	
(11) LRS MILE POINT			0.000 MI
(105) FEDERAL LANDS HIGHWAY			N/A (NBI)
(20) TOLL			Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY			County Hwy Agency
(22) OWNER			County Hwy Agency
(37) HISTORICAL SIGNIFICANCE			Possibly eligible for
(101) PARALLEL STRUCTURE			No || bridge exists
(103) TEMPORARY STRUCTURE			Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	50
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2006
(27) YEAR BUILT	1927
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	1.900 MI

LOAD RATING

(66) INVENTORY LOAD RATING	21 ton, HS 11.00
(64) MAXIMUM LOAD RATING	35 ton, HS 18.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posting Recommended

SCHEDULE

(90) ROUTINEINSPECTION DATE				12/02/2010
(91) ROUTINE INSPECTION FREQUENCY				24 MO
(92) CRITICAL FEATURE INSPECTION:				(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)	
B) UNDERWATER INSP	N	MO	B)	
C) SPECIAL INSP	N	MO	C)	

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	22.00 FT
(94) BRIDGE COST	$40000
(95) ROADWAY COST	$5000
(96) TOTAL COST	$52000
(97) COST ESTIMATE YEAR	2009
(114) FUTURE ADT	50
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	22.6 FT
(48) MAXIMUM SPAN LENGTH	21.0 FT
(32) ROUTE WIDTH	11.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	19.4 FT
(52) DECK WIDTH OUT TO OUT	22.5 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	19.0 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Slab
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	7
(59) SUPERSTRUCTURE CONDITION	7
(60) SUBSTRUCTURE CONDITION	7
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	4
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	78.00
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

View across the bridge to the east

Profile view of the bridge to the north


2011/ 6/22
N mag


2011/ 6/22
ESE mag

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} is sediment size

Inputs		Conversion (ft)
Q (m^3/s) =	17.00	607
y_0 (m) =	1.525	5
w_{culv} (m) =	6.405	21
D_{50} (m) =	0.0127	0.042

Outputs		Conversion (ft)
V_{RA} (m/s) =	1.74	5.71
A_{culv} (m^2) =	9.77	105.14
V_{CL} (m/s) =	1.58	5.17
y_2 (m) =	1.68	5.52

y_{max} (m) =	3.82	Without wingwalls
y_{max} (m) =	2.97	With wingwalls
Conversion (ft)		
y_{max} (ft) =	12.52	Without wingwalls
y_{max} (ft) =	9.73	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	607
y_0 (ft) =	5
w_{culv} (ft) =	21
w_a (ft) =	26
D_{50} (ft) =	0.042

Outputs	
V_{RM} (ft/s) =	7.64
A_{culv} (ft^2) =	105
V_{CN} (ft/s) =	5.85
y_2 (ft) =	6.53
q_1/q_2 =	0.81
x =	0.232

y_{max} (ft) =	9.90	Without wingwalls
y_{max} (ft) =	9.44	With wingwalls

Built = 1927

Bridge # = 000080865806460

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2.5

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
120.00	94.65	1.87	1.28	1.87	3-M2t	6.35	0.86	1.69	1.69	2.66	3.38
240.00	192.63	2.92	2.06	2.92	3-M2t	8.00	1.38	2.64	2.64	3.47	4.32
360.00	291.76	3.81	2.72	3.81	3-M2t	8.00	1.82	3.45	3.45	4.02	4.96
480.00	392.29	4.61	3.31	4.61	3-M2t	8.00	2.22	4.19	4.19	4.46	5.46
600.00	493.57	5.36	3.86	5.36	3-M2t	8.00	2.58	4.88	4.88	4.82	5.86
720.00	582.16	6.05	4.32	6.05	3-M2t	8.00	2.89	5.53	5.53	5.01	6.20
840.00	588.34	6.59	4.35	6.59	3-M2t	8.00	2.91	6.16	6.16	4.55	6.49
960.00	600.37	7.14	4.42	7.14	3-M2t	8.00	2.95	6.78	6.77	4.22	6.75
1008.00	606.92	7.36	4.45	7.36	3-M2t	8.00	2.97	7.01	7.01	4.12	6.84
1200.00	636.33	8.25	4.60	8.25	3-M2t	8.00	3.06	7.95	7.95	3.81	7.19

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000080875006464**	(1) STATE	**Kansas**	(4) CITY	**Rural**	(3) COUNTY	**Butler**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			ROCK CREEK
(9) LOCATION			2.0E 2.4S OF SMILEYBERG
(16) LATITUDE			37 ° 29 ' 06.01 "
(17) LONGITUDE			96 ° 50 ' 38.44 "
(2) HIGHWAY AGENCY DISTRICT			Hutchinson
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL 35E4-29-5

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION			Rural Local
(104) NHS DESIGNATION			Not on NHS
(100) STRAHNET DESIGNATION			Not a STRAHNET hwy
(110) NATIONAL TRUCK NET			Not part of natl netwo
(12) BASE HIGHWAY NET			Not on Base Network
(13A) LRS INVENTORY ROUTE		(13B) LRS SUBRTE #	
(11) LRS MILE POINT			0.000 MI
(105) FEDERAL LANDS HIGHWAY			N/A (NBI)
(20) TOLL			Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY			County Hwy Agency
(22) OWNER			County Hwy Agency
(37) HISTORICAL SIGNIFICANCE			Possibly eligible for
(101) PARALLEL STRUCTURE			No || bridge exists
(103) TEMPORARY STRUCTURE			Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	50
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2006
(27) YEAR BUILT	1918
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	1-lane Br for 2-way
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	1
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.730 MI

LOAD RATING

(66) INVENTORY LOAD RATING	18 ton, HS 9.00
(64) MAXIMUM LOAD RATING	31 ton, HS 16.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posting Recommended

SCHEDULE

(90) ROUTINEINSPECTION DATE			12/02/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Not Applicable (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	FT
(94) BRIDGE COST	
(95) ROADWAY COST	
(96) TOTAL COST	
(97) COST ESTIMATE YEAR	
(114) FUTURE ADT	50
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	34.1 FT
(48) MAXIMUM SPAN LENGTH	33.1 FT
(32) ROUTE WIDTH	10.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	15.7 FT
(52) DECK WIDTH OUT TO OUT	17.7 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	15.4 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	5
(59) SUPERSTRUCTURE CONDITION	4
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	5

APPRAISAL

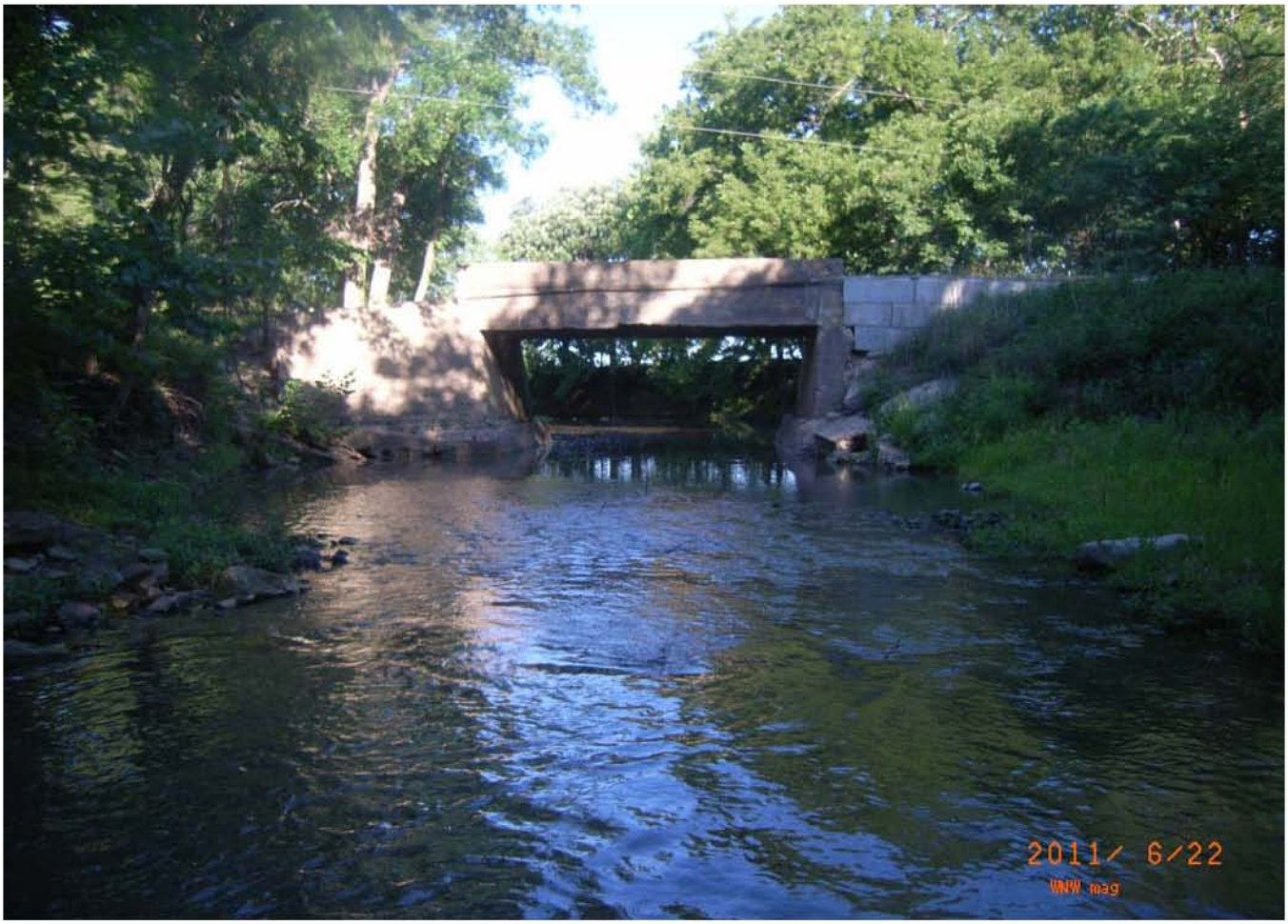
DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	4
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	4
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	8
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	53.00
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

View across the bridge to the north

Profile view of the bridge to the west


2011/ 6/22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METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} is sediment size

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	42.36	1513	V_{RA} (m/s) =	1.73	5.66
y_0 (m) =	2.44	8	A_{culv} (m^2) =	24.56	264.35
w_{culv} (m) =	10.065	33	V_{CL} (m/s) =	1.68	5.52
D_{50} (m) =	0.0127	0.042	y_2 (m) =	2.50	8.20

y_{max} (m) =	5.67	Without wingwalls
y_{max} (m) =	4.40	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	18.59	Without wingwalls
y_{max} (ft) =	14.45	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1513
y_0 (ft) =	8
w_{culv} (ft) =	33
w_a (ft) =	40
D_{50} (ft) =	0.042

Outputs	
V_{RM} (ft/s) =	7.66
A_{culv} (ft^2) =	264
V_{CN} (ft/s) =	6.39
y_2 (ft) =	9.59
q_1/q_2 =	0.83
x =	0.232

y_{max} (ft) =	14.53	Without wingwalls
y_{max} (ft) =	13.86	With wingwalls

Built = 1918

Bridge # = 000080875006464

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 5

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
210.00	169.97	1.82	1.40	1.97	3-M2t	6.00	0.94	1.77	1.77	2.91	3.59
420.00	340.96	2.81	2.23	3.04	3-M2t	10.00	1.49	2.74	2.74	3.77	4.64
630.00	513.14	3.64	2.93	3.95	3-M2t	10.00	1.96	3.56	3.55	4.37	5.37
840.00	685.51	4.38	3.55	4.76	3-M2t	10.00	2.38	4.29	4.28	4.85	5.94
1050.00	858.45	5.07	4.13	5.52	3-M2t	10.00	2.77	4.96	4.96	5.24	6.41
1260.00	1031.93	5.72	4.66	6.22	3-M2t	10.00	3.13	5.60	5.60	5.58	6.82
1470.00	1205.91	6.34	5.18	6.90	3-M2t	10.00	3.47	6.21	6.21	5.88	7.17
1680.00	1380.06	6.94	5.70	7.54	3-M2t	10.00	3.80	6.80	6.80	6.15	7.49
1890.00	1482.77	7.65	6.00	8.10	3-M2t	10.00	3.98	7.37	7.37	6.10	7.78
1980.00	1513.11	7.96	6.09	8.32	3-M2t	10.00	4.04	7.61	7.60	6.03	7.89

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000080883006004**	(1) STATE	**Kansas**	(4) CITY	**Rural**	(3) COUNTY	**Butler**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Replacement**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			BIRD CREEK
(9) LOCATION			4.5E OF ELDORADO
(16) LATITUDE			37 ° 49 ' 07.95 "
(17) LONGITUDE			96 ° 46 ' 15.79 "
(2) HIGHWAY AGENCY DISTRICT			Hutchinson
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL 4E4-26-6

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	35
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2006
(27) YEAR BUILT	1915
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	1.900 MI

LOAD RATING

(66) INVENTORY LOAD RATING	12 ton, HS 6.00
(64) MAXIMUM LOAD RATING	20 ton, HS 10.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	>39.9% below
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			12/14/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	39.00 FT
(94) BRIDGE COST	$44000
(95) ROADWAY COST	$4000
(96) TOTAL COST	$66000
(97) COST ESTIMATE YEAR	2009
(114) FUTURE ADT	35
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	34.1 FT
(48) MAXIMUM SPAN LENGTH	32.2 FT
(32) ROUTE WIDTH	20.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	16.4 FT
(52) DECK WIDTH OUT TO OUT	18.0 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	25.0 °
(47) ROUTE HORIZONTAL CLEARANCE	16.4 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	3
(59) SUPERSTRUCTURE CONDITION	3
(60) SUBSTRUCTURE CONDITION	4
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Structurally Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	3
(68) DECK WIDTH APPRAISAL	3
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	21.40
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

View across the bridge to the south

Profile view of the bridge to the west


2011/ 5/20 15:26


2011/ 5/20 15:28

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} is sediment size

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	35.90	1282	V_{RA} (m/s) =	1.60	5.24
y_0 (m) =	2.2875	7.5	A_{culv} (m^2) =	22.47	241.82
w_{culv} (m) =	9.821	32.2	V_{CL} (m/s) =	2.01	6.59
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.82	5.96

y_{max} (m) =	4.12	Without wingwalls
y_{max} (m) =	3.20	With wingwalls
Conversion (ft)		
y_{max} (ft) =	13.51	Without wingwalls
y_{max} (ft) =	10.50	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1282
y_0 (ft) =	7.5
w_{culv} (ft) =	32.2
w_a (ft) =	40
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	7.00
A_{culv} (ft^2) =	241.5
V_{CN} (ft/s) =	7.20
y_2 (ft) =	7.29
q_1/q_2 =	0.81
x =	0.202

y_{max} (ft) =	11.05	Without wingwalls
y_{max} (ft) =	10.54	With wingwalls

Built = 1915

Bridge # = 000080883006004

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 3

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
200.00	161.62	1.79	1.38	1.94	3-M2t	5.94	0.92	1.75	1.75	2.87	3.56
400.00	324.23	2.76	2.19	3.00	3-M2t	9.00	1.47	2.70	2.70	3.72	4.60
600.00	487.65	3.58	2.88	3.90	3-M2t	9.00	1.93	3.51	3.51	4.32	5.32
800.00	651.32	4.32	3.49	4.69	3-M2t	9.00	2.34	4.23	4.23	4.79	5.88
1000.00	816.16	5.00	4.05	5.44	3-M2t	9.00	2.72	4.89	4.89	5.18	6.35
1200.00	982.02	5.64	4.59	6.14	3-M2t	9.00	3.07	5.53	5.53	5.52	6.74
1400.00	1143.66	6.25	5.11	6.80	3-M2t	9.00	3.40	6.13	6.13	5.80	7.10
1600.00	1237.28	6.98	5.41	7.36	3-M2t	9.00	3.59	6.71	6.71	5.73	7.41
1738.00	1282.31	7.48	5.54	7.72	3-M2t	9.00	3.67	7.10	7.10	5.61	7.61
2000.00	1394.29	8.48	5.88	8.42	3-M2t	9.00	3.88	7.82	7.82	5.54	7.95

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000080889005844**	(1) STATE	**Kansas**	(4) CITY	**Rural**	(3) COUNTY	**Butler**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Replacement**

IDENTIFICATION

(5B) ROUTE TYPE	County Hwy
(5C) SERVICE TYPE	Mainline
(5D) ROUTE NUMBER 00000	(5E) SUFFIX N/A (NBI)
(6A) FEATURE INTERSECTED	DURECHAN CREEK
(9) LOCATION	8.0E 3.4S OF DEGRAFF
(16) LATITUDE	37 ° 56 ' 09.54 "
(17) LONGITUDE	96 ° 43 ' 45.07 "
(2) HIGHWAY AGENCY DISTRICT	Hutchinson
(98A) BORDER BRIDGE STATE	Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY	%
(99) BORDER BRIDGE STRUCTURE NO.	_
(7) (ROUTE NAME) FACILITY CARRIED	LOCAL 25E4-24-6

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	25
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2010
(27) YEAR BUILT	1915
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	1.900 MI

LOAD RATING

(66) INVENTORY LOAD RATING	5 ton, HS 2.00
(64) MAXIMUM LOAD RATING	9 ton, HS 4.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	>39.9% below
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			12/04/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	68.00 FT
(94) BRIDGE COST	$150000
(95) ROADWAY COST	$40000
(96) TOTAL COST	$240000
(97) COST ESTIMATE YEAR	2009
(114) FUTURE ADT	25
(115) FUTURE ADT YEAR	2031

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	33.1 FT
(48) MAXIMUM SPAN LENGTH	30.8 FT
(32) ROUTE WIDTH	18.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	17.4 FT
(52) DECK WIDTH OUT TO OUT	18.4 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	17.1 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	5
(59) SUPERSTRUCTURE CONDITION	4
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	5

APPRAISAL

DEFICIENCY STATUS	Structurally Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	4
(113) SCOUR VULNERABILITY	4
(67) STRUCTURAL EVALUATION	3
(68) DECK WIDTH APPRAISAL	3
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	34.00
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

View across the bridge to the south

Profile view of the bridge to the west


283° WNW mag
W:096° 42' 44.09"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} is sediment size

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	20.72	740	V_{RA} (m/s) =	1.81	5.93
y_0 (m) =	1.22	4	A_{culv} (m^2) =	11.46	123.36
w_{culv} (m) =	9.394	30.8	V_{CL} (m/s) =	1.53	5.03
D_{50} (m) =	0.0127	0.042	y_2 (m) =	1.44	4.71

y_{max} (m) =	3.26	Without wingwalls
y_{max} (m) =	2.53	With wingwalls
Conversion (ft)		
y_{max} (ft) =	10.68	Without wingwalls
y_{max} (ft) =	8.30	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	740
y_0 (ft) =	4
w_{culv} (ft) =	30.8
w_a (ft) =	40
D_{50} (ft) =	0.042

Outputs	
V_{RM} (ft/s) =	7.81
A_{culv} (ft^2) =	123.2
V_{CN} (ft/s) =	5.63
y_2 (ft) =	5.55
q_1/q_2 =	0.77
x =	0.232

y_{max} (ft) =	8.41	Without wingwalls
y_{max} (ft) =	8.02	With wingwalls

Built = 1915

Bridge # = 000080889005844

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 4

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
150.00	120.34	1.54	1.17	1.67	3-M2t	5.09	0.78	1.50	1.50	2.60	3.24
300.00	242.01	2.37	1.86	2.58	3-M2t	6.00	1.24	2.32	2.32	3.38	4.19
450.00	364.23	3.07	2.44	3.34	3-M2t	6.00	1.64	3.01	3.01	3.93	4.86
600.00	486.97	3.69	2.96	4.02	3-M2t	6.00	1.98	3.62	3.62	4.36	5.38
750.00	602.28	4.28	3.44	4.64	3-M2t	6.00	2.29	4.19	4.19	4.67	5.81
900.00	653.82	4.98	3.64	5.13	3-M2t	6.00	2.41	4.72	4.72	4.49	6.19
1050.00	715.75	5.69	3.88	5.63	3-M2t	6.00	2.57	5.23	5.23	4.44	6.52
1108.00	740.83	5.95	3.98	5.82	3-M2t	6.00	2.62	5.43	5.42	4.43	6.63
1350.00	875.35	6.94	4.48	6.68	4-FFf	6.00	2.93	6.00	6.20	4.74	7.07
1500.00	968.78	7.47	4.82	7.25	4-FFf	6.00	3.14	6.00	6.66	5.24	7.32

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000080891005740**	(1) STATE	**Kansas**	(4) CITY	**Rural**	(3) COUNTY	**Butler**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Replacement**

IDENTIFICATION

(5B) ROUTE TYPE	County Hwy
(5C) SERVICE TYPE	Mainline
(5D) ROUTE NUMBER 00000	(5E) SUFFIX N/A (NBI)
(6A) FEATURE INTERSECTED	EAST BRANCH WALNUT RIVER
(9) LOCATION	3.0W 2.0S OF CASSODAY
(16) LATITUDE	38 ° 00 ' 49.91 "
(17) LONGITUDE	96 ° 42 ' 42.66 "
(2) HIGHWAY AGENCY DISTRICT	Hutchinson
(98A) BORDER BRIDGE STATE	Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY	%
(99) BORDER BRIDGE STRUCTURE NO.	_
(7) (ROUTE NAME) FACILITY CARRIED	LOCAL 31N9-23-7

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	30
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2010
(27) YEAR BUILT	1919
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	1-lane Br for 2-way
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	1
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	1.900 MI

LOAD RATING

(66) INVENTORY LOAD RATING	11 ton, HS 5.00
(64) MAXIMUM LOAD RATING	19 ton, HS 10.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	10.0-19.9%below
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			11/27/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Repl-Load Capacity
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	80.00 FT
(94) BRIDGE COST	$180000
(95) ROADWAY COST	$60000
(96) TOTAL COST	$305000
(97) COST ESTIMATE YEAR	2009
(114) FUTURE ADT	30
(115) FUTURE ADT YEAR	2031

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	48.9 FT
(48) MAXIMUM SPAN LENGTH	46.9 FT
(32) ROUTE WIDTH	16.1 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	15.8 FT
(52) DECK WIDTH OUT TO OUT	20.3 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	15.8 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Stringer/Girder
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	5
(59) SUPERSTRUCTURE CONDITION	5
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Structurally Deficient
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	4
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	2
(68) DECK WIDTH APPRAISAL	8
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	40.40
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

View across the bridge to the west

Profile of the bridge to the north


2011/ 5/19 16:01
121°ESE mag
W:096°41'43.30"


2011/ 5/19 16:00
339°NNW mag
W:096°41'46.01"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} is sediment size (in) 2

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	49.14	1755	V_{RA} (m/s) =	1.41	4.62
y_0 (m) =	2.44	8	A_{culv} (m^2) =	34.90	375.70
w_{culv} (m) =	14.30	46.9	V_{CL} (m/s) =	2.43	7.97
D_{50} (m) =	0.0508	0.167	y_2 (m) =	1.41	4.64

y_{max} (m) =	3.20	Without wingwalls
y_{max} (m) =	2.49	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	10.51	Without wingwalls
y_{max} (ft) =	8.17	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1755
y_0 (ft) =	8
w_{culv} (ft) =	46.9
w_a (ft) =	52
D_{50} (ft) =	0.167

Outputs	
V_{RM} (ft/s) =	7.01
A_{culv} (ft^2) =	375.2
V_{CN} (ft/s) =	8.55
y_2 (ft) =	6.55
q_1/q_2 =	0.90
x =	0.176

y_{max} (ft) =	9.93	Without wingwalls
y_{max} (ft) =	9.47	With wingwalls

Built = 1919

Bridge # = 000080891005740

Channel Bottom= Boulders and Cobbles

Measured Scour (ft) = 3

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
250.00	205.41	1.64	1.26	1.76	3-M2t	5.41	0.84	1.57	1.57	2.79	3.40
500.00	411.71	2.52	2.00	2.70	3-M2t	8.00	1.34	2.41	2.41	3.64	4.42
750.00	618.47	3.25	2.62	3.49	3-M2t	8.00	1.76	3.11	3.11	4.24	5.15
1000.00	825.01	3.89	3.18	4.19	3-M2t	8.00	2.13	3.73	3.73	4.72	5.72
1250.00	1031.94	4.49	3.69	4.83	3-M2t	8.00	2.47	4.30	4.29	5.12	6.21
1500.00	1239.07	5.05	4.18	5.43	3-M2t	8.00	2.79	4.83	4.83	5.47	6.62
1750.00	1462.31	5.55	4.70	6.02	3-M2t	8.00	3.12	5.33	5.33	5.84	7.00
2000.00	1635.22	6.12	5.08	6.53	3-M2t	8.00	3.36	5.82	5.82	5.99	7.33
2250.00	1755.06	6.85	5.34	6.99	3-M2t	8.00	3.52	6.28	6.28	5.95	7.63
2500.00	1902.20	7.54	5.66	7.45	3-M2t	8.00	3.72	6.73	6.73	6.02	7.92

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000080891606268**	(1) STATE	**Kansas**	(4) CITY	**Rural**	(3) COUNTY	**Butler**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Rehabilitation**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			STONY CREEK
(9) LOCATION			2.4W 6.2N OF LATHAM
(16) LATITUDE			37 ° 37 ' 29.79 "
(17) LONGITUDE			96 ° 41 ' 15.37 "
(2) HIGHWAY AGENCY DISTRICT			Hutchinson
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			Local 8C6-28-7

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION			Rural Local
(104) NHS DESIGNATION			Not on NHS
(100) STRAHNET DESIGNATION			Not a STRAHNET hwy
(110) NATIONAL TRUCK NET			Not part of natl netwo
(12) BASE HIGHWAY NET			Not on Base Network
(13A) LRS INVENTORY ROUTE		(13B) LRS SUBRTE #	
(11) LRS MILE POINT			0.000 MI
(105) FEDERAL LANDS HIGHWAY			N/A (NBI)
(20) TOLL			Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY			County Hwy Agency
(22) OWNER			County Hwy Agency
(37) HISTORICAL SIGNIFICANCE			Possibly eligible for
(101) PARALLEL STRUCTURE			No || bridge exists
(103) TEMPORARY STRUCTURE			Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	30
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2006
(27) YEAR BUILT	1917
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.700 MI

LOAD RATING

(66) INVENTORY LOAD RATING	17 ton, HS 8.00
(64) MAXIMUM LOAD RATING	28 ton, HS 15.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			12/07/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	27.00 FT
(94) BRIDGE COST	$40000
(95) ROADWAY COST	$2000
(96) TOTAL COST	$50000
(97) COST ESTIMATE YEAR	2009
(114) FUTURE ADT	30
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	26.9 FT
(48) MAXIMUM SPAN LENGTH	25.9 FT
(32) ROUTE WIDTH	12.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	16.4 FT
(52) DECK WIDTH OUT TO OUT	19.8 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	16.1 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	5
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Functionally Obsolete
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	4
(68) DECK WIDTH APPRAISAL	3
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	55.30
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

View across the bridge to the west

Profile view of the bridge to the north

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	21.01	750.4	V_{RA} (m/s) =	1.96	6.41
y_0 (m) =	1.3603	4.46	A_{culv} (m^2) =	10.75	115.67
w_{culv} (m) =	7.8995	25.9	V_{CL} (m/s) =	1.92	6.30
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.38	4.54

y_{max} (m) =	3.14	Without wingwalls
y_{max} (m) =	2.44	With wingwalls
Conversion (ft)		
y_{max} (ft) =	10.29	Without wingwalls
y_{max} (ft) =	8.00	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	750.4
y_0 (ft) =	4.46
w_{culv} (ft) =	25.9
w_a (ft) =	30
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	9.05
A_{culv} (ft^2) =	115.514
V_{CN} (ft/s) =	6.89
y_2 (ft) =	5.86
q_1/q_2 =	0.86
x =	0.202

y_{max} (ft) =	8.87	Without wingwalls
y_{max} (ft) =	8.47	With wingwalls

Built = 1917

Bridge # = 000080891606268

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
150.00	115.98	1.70	1.28	1.87	3-M2t	6.41	0.86	1.69	1.69	2.65	3.43
300.00	235.73	2.64	2.05	2.90	3-M2t	8.00	1.37	2.62	2.62	3.47	4.42
450.00	356.95	3.43	2.70	3.77	3-M2t	8.00	1.81	3.41	3.41	4.04	5.09
600.00	479.13	4.15	3.29	4.56	3-M2t	8.00	2.20	4.12	4.12	4.49	5.62
750.00	602.71	4.81	3.83	5.29	3-M2t	8.00	2.57	4.79	4.79	4.86	6.05
900.00	722.30	5.44	4.34	5.97	3-M2t	8.00	2.90	5.42	5.41	5.15	6.42
1050.00	743.50	6.07	4.43	6.49	3-M2t	8.00	2.95	6.02	6.02	4.77	6.74
1200.00	748.73	6.67	4.45	6.99	3-M2t	8.00	2.97	6.60	6.60	4.38	7.02
1243.00	750.42	6.83	4.46	7.14	3-M2t	8.00	2.97	6.76	6.76	4.28	7.10
1500.00	764.88	7.84	4.52	8.01	3-M2t	8.00	3.01	7.71	7.71	3.83	7.51

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000290545005901**	(1) STATE	**Kansas**	(4) CITY **Rural**		(3) COUNTY	**Ford**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			TRIB. TO SAWLOG CREEK
(9) LOCATION			3.1N 6.0W OF SPEARVILLE
(16) LATITUDE			37 ° 53 ' 47.80 "
(17) LONGITUDE			99 ° 51 ' 49.10 "
(2) HIGHWAY AGENCY DISTRICT			Garden City
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL RD. 50

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION			Rural Local
(104) NHS DESIGNATION			Not on NHS
(100) STRAHNET DESIGNATION			Not a STRAHNET hwy
(110) NATIONAL TRUCK NET			Not part of natl netwo
(12) BASE HIGHWAY NET			Not on Base Network
(13A) LRS INVENTORY ROUTE		(13B) LRS SUBRTE #	
(11) LRS MILE POINT			0.000 MI
(105) FEDERAL LANDS HIGHWAY			N/A (NBI)
(20) TOLL			Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY			County Hwy Agency
(22) OWNER			County Hwy Agency
(37) HISTORICAL SIGNIFICANCE			Possibly eligible for
(101) PARALLEL STRUCTURE			No || bridge exists
(103) TEMPORARY STRUCTURE			Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	30
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2010
(27) YEAR BUILT	1937
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	4.000 MI

LOAD RATING

(66) INVENTORY LOAD RATING	13 ton, HS 6.00
(64) MAXIMUM LOAD RATING	21 ton, HS 11.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	AS Allowable Stress
(63) OPERATING (MAX) LOAD RATING METHOD	AS Allowable Stress
(70) POSTING REQUIREMENTS	0.1-9.9%below
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			12/02/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Not Applicable (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	FT
(94) BRIDGE COST	
(95) ROADWAY COST	
(96) TOTAL COST	
(97) COST ESTIMATE YEAR	2000
(114) FUTURE ADT	30
(115) FUTURE ADT YEAR	2030

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	26.9 FT
(48) MAXIMUM SPAN LENGTH	24.9 FT
(32) ROUTE WIDTH	22.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	23.6 FT
(52) DECK WIDTH OUT TO OUT	24.3 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	23.3 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	99.9 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Stringer/Girder
(43A) MAIN SPAN MATERIAL TYPE	Steel
(107) DECK TYPE	Wood or Timber
(108A) DECK SURFACE	Gravel
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	_
(67) STRUCTURAL EVALUATION	4
(68) DECK WIDTH APPRAISAL	5
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	63.30
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


MAY 02 2011


MAY 02 2011

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	30.80	1100	V_{RA} (m/s) =	2.24	7.35
y_0 (m) =	1.80865	5.93	A_{culv} (m^2) =	13.74	147.85
w_{culv} (m) =	7.5945	24.9	V_{CL} (m/s) =	2.04	6.69
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.99	6.52

y_{max} (m) =	4.50	Without wingwalls
y_{max} (m) =	3.50	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	14.77	Without wingwalls
y_{max} (ft) =	11.48	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1100
y_0 (ft) =	5.93
w_{culv} (ft) =	24.9
w_a (ft) =	33
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	9.65
A_{culv} (ft^2) =	147.657
V_{CN} (ft/s) =	7.31
y_2 (ft) =	7.83
q_1/q_2 =	0.75
x =	0.202

y_{max} (ft) =	11.86	Without wingwalls
y_{max} (ft) =	11.32	With wingwalls

Built = 1937

Bridge # = 000290545005901

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
150.00	109.19	1.61	1.27	1.79	3-M2t	6.22	0.84	1.60	1.59	2.75	3.78
300.00	222.57	2.50	2.03	2.78	3-M2t	10.00	1.36	2.48	2.47	3.61	4.87
450.00	337.61	3.25	2.67	3.61	3-M2t	10.00	1.79	3.22	3.22	4.21	5.61
600.00	453.84	3.93	3.25	4.36	3-M2t	10.00	2.18	3.89	3.89	4.68	6.19
750.00	570.94	4.56	3.79	5.06	3-M2t	10.00	2.54	4.51	4.51	5.08	6.67
900.00	690.32	5.15	4.30	5.72	3-M2t	10.00	2.89	5.11	5.11	5.43	7.08
1050.00	810.03	5.72	4.79	6.35	3-M2t	10.00	3.21	5.67	5.67	5.73	7.43
1200.00	929.07	6.27	5.26	6.96	3-M2t	10.00	3.52	6.22	6.22	6.00	7.75
1350.00	1050.63	6.81	5.74	7.55	3-M2t	10.00	3.82	6.75	6.75	6.25	8.03
1440.00	1100.71	7.13	5.93	7.86	3-M2t	10.00	3.94	7.06	7.06	6.26	8.19

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000310901804505**	(1) STATE	**Kansas**	(4) CITY **Rural**		(3) COUNTY	**Geary**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Rehabilitation**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			EAST BRANCH HUMBOLDT CR.
(9) LOCATION			7.0S 14.0E JUNCTION CITY
(16) LATITUDE			38 ° 54 ' 29.00 "
(17) LONGITUDE			96 ° 33 ' 56.00 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			GARANSON RD.

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION		Rural Local
(104) NHS DESIGNATION		Not on NHS
(100) STRAHNET DESIGNATION		Not a STRAHNET hwy
(110) NATIONAL TRUCK NET		Not part of natl netwo
(12) BASE HIGHWAY NET		Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #	
(11) LRS MILE POINT		0.000 MI
(105) FEDERAL LANDS HIGHWAY		N/A (NBI)
(20) TOLL		Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY		County Hwy Agency
(22) OWNER		County Hwy Agency
(37) HISTORICAL SIGNIFICANCE		Not eligible for NRHP
(101) PARALLEL STRUCTURE		No || bridge exists
(103) TEMPORARY STRUCTURE		Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	10
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2004
(27) YEAR BUILT	1965
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	1-lane Br for 2-way
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.700 MI

LOAD RATING

(66) INVENTORY LOAD RATING	21 ton, HS 11.00
(64) MAXIMUM LOAD RATING	28 ton, HS 15.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	AS Allowable Stress
(63) OPERATING (MAX) LOAD RATING METHOD	AS Allowable Stress
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posting Recommended

SCHEDULE

(90) ROUTINEINSPECTION DATE			12/03/2009
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	41.00 FT
(94) BRIDGE COST	$38000
(95) ROADWAY COST	$4000
(96) TOTAL COST	$57000
(97) COST ESTIMATE YEAR	1997
(114) FUTURE ADT	15
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	41.0 FT
(48) MAXIMUM SPAN LENGTH	39.0 FT
(32) ROUTE WIDTH	18.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	17.5 FT
(52) DECK WIDTH OUT TO OUT	17.5 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	20.0 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Prestressed Concrete
(107) DECK TYPE	Concrete Precast Panel
(108A) DECK SURFACE	Monolithic Concrete
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	7
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	5

APPRAISAL

DEFICIENCY STATUS	Functionally Obsolete
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	5
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	3
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	64.90
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


2011/ 8/17


2011/ 8/17

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 2

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	40.77	1456	V_{RA} (m/s) =	2.12	6.95
y_0 (m) =	1.6165	5.3	A_{culv} (m^2) =	19.23	206.97
w_{culv} (m) =	11.895	39	V_{CL} (m/s) =	2.43	7.97
D_{50} (m) =	0.0508	0.167	y_2 (m) =	1.41	4.63

y_{max} (m) =	3.20	Without wingwalls
y_{max} (m) =	2.49	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	10.49	Without wingwalls
y_{max} (ft) =	8.15	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1456
y_0 (ft) =	5.3
w_{culv} (ft) =	39
w_a (ft) =	46
D_{50} (ft) =	0.167

Outputs	
V_{RM} (ft/s) =	9.62
A_{culv} (ft^2) =	206.7
V_{CN} (ft/s) =	8.43
y_2 (ft) =	6.05
q_1/q_2 =	0.85
x =	0.176

y_{max} (ft) =	9.16	Without wingwalls
y_{max} (ft) =	8.74	With wingwalls

Built = 1965

Bridge # = 000310901804505

Channel Bottom= Gravel and sand

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
250.00	193.87	1.79	1.37	1.96	3-M2t	6.26	0.92	1.77	1.77	2.81	3.62
500.00	390.64	2.75	2.18	3.03	3-M2t	9.00	1.46	2.73	2.73	3.67	4.70
750.00	588.00	3.56	2.87	3.92	3-M2t	9.00	1.92	3.53	3.53	4.27	5.45
1000.00	786.20	4.29	3.48	4.72	3-M2t	9.00	2.33	4.25	4.24	4.75	6.04
1250.00	984.99	4.95	4.04	5.45	3-M2t	9.00	2.71	4.91	4.91	5.15	6.53
1500.00	1184.92	5.58	4.58	6.14	3-M2t	9.00	3.07	5.53	5.53	5.49	6.95
1750.00	1380.18	6.18	5.10	6.80	3-M2t	9.00	3.40	6.12	6.12	5.78	7.33
2000.00	1438.85	6.78	5.25	7.30	3-M2t	9.00	3.49	6.69	6.69	5.51	7.66
2106.00	1456.08	7.05	5.30	7.51	3-M2t	9.00	3.52	6.93	6.93	5.39	7.79
2500.00	1533.69	8.06	5.49	8.28	3-M2t	9.00	3.64	7.78	7.78	5.06	8.24

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000390737606760**	(1) STATE	**Kansas**	(4) CITY **Rural**	(3) COUNTY	**Harper**
(5A) ROUTE ON/UNDER	**Route On Structure**				HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE	County Hwy
(5C) SERVICE TYPE	Mainline
(5D) ROUTE NUMBER 00000	(5E) SUFFIX N/A (NBI)
(6A) FEATURE INTERSECTED	STREAM
(9) LOCATION	1.0S 3.4W OF HARPER
(16) LATITUDE	37 ° 16 ' 04.70 "
(17) LONGITUDE	98 ° 04 ' 53.40 "
(2) HIGHWAY AGENCY DISTRICT	Hutchinson
(98A) BORDER BRIDGE STATE	Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY	%
(99) BORDER BRIDGE STRUCTURE NO.	_
(7) (ROUTE NAME) FACILITY CARRIED	LOCAL 9.0-0.6

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	30
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2011
(27) YEAR BUILT	1925
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	2.000 MI

LOAD RATING

(66) INVENTORY LOAD RATING	15 ton, HS 7.00
(64) MAXIMUM LOAD RATING	20 ton, HS 10.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	AS Allowable Stress
(63) OPERATING (MAX) LOAD RATING METHOD	AS Allowable Stress
(70) POSTING REQUIREMENTS	10.0-19.9%below
(41) POSTING STATUS	Posting Recommended

SCHEDULE

(90) ROUTINEINSPECTION DATE			01/25/2011
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen
(75B) WORK BY	Owner_s Forces
(76) IMPROVEMENT LENGTH	22.00 FT
(94) BRIDGE COST	$20000
(95) ROADWAY COST	$2000
(96) TOTAL COST	$31000
(97) COST ESTIMATE YEAR	2007
(114) FUTURE ADT	30
(115) FUTURE ADT YEAR	2031

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	22.0 FT
(48) MAXIMUM SPAN LENGTH	20.0 FT
(32) ROUTE WIDTH	21.2 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	18.0 FT
(52) DECK WIDTH OUT TO OUT	20.0 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	18.0 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	99.9 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete Continuous
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Gravel
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	_
(67) STRUCTURAL EVALUATION	4
(68) DECK WIDTH APPRAISAL	4
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	61.30
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


UIC 2011:05:04 22:40:52
8° N tru
W:098° 04' 54.078"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)
Q (m^3/s) =	8.64	308.6
y_0 (m) =	0.8967	2.94
w_{culv} (m) =	6.1	20
D_{50} (m) =	0.0254	0.083

Outputs		Conversion (ft)
V_{RA} (m/s) =	1.58	5.18
A_{culv} (m^2) =	5.47	58.88
V_{CL} (m/s) =	1.76	5.76
y_2 (m) =	0.81	2.65

y_{max} (m) =	1.83	Without wingwalls
y_{max} (m) =	1.42	With wingwalls
Conversion (ft)		
y_{max} (ft) =	6.00	Without wingwalls
y_{max} (ft) =	4.66	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{U1} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	308.6
y_0 (ft) =	2.94
w_{culv} (ft) =	20
w_a (ft) =	27
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	6.78
A_{culv} (ft^2) =	58.8
V_{CN} (ft/s) =	6.12
y_2 (ft) =	3.26
q_1/q_2 =	0.74
x =	0.202

y_{max} (ft) =	4.93	Without wingwalls
y_{max} (ft) =	4.71	With wingwalls

Built = 1925

Bridge # = 000390737606760

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2.5

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
80.00	63.09	1.37	1.01	1.50	3-M2t	5.00	0.68	1.36	1.35	2.33	2.95
160.00	128.18	2.12	1.62	2.32	3-M2t	5.00	1.09	2.11	2.11	3.04	3.80
240.00	194.25	2.76	2.14	3.02	3-M2t	5.00	1.43	2.74	2.74	3.54	4.38
320.00	261.63	3.34	2.62	3.65	3-M2t	5.00	1.75	3.32	3.32	3.94	4.83
400.00	275.29	3.91	2.71	4.12	3-M2t	5.00	1.81	3.85	3.85	3.57	5.19
480.00	288.60	4.49	2.80	4.59	3-M2t	5.00	1.87	4.36	4.36	3.31	5.51
560.00	302.44	5.06	2.90	5.05	3-M2t	5.00	1.93	4.85	4.84	3.12	5.78
600.00	308.64	5.33	2.94	5.30	4-FFf	5.00	1.95	5.00	5.08	3.09	5.90
720.00	333.93	6.14	3.11	6.03	4-FFf	5.00	2.06	5.00	5.77	3.34	6.24
800.00	354.89	6.65	3.24	6.51	4-FFf	5.00	2.14	5.00	6.22	3.55	6.43

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	000450731003104	(1) STATE	Kansas	(4) CITY Rural		(3) COUNTY	Jewell
(5A) ROUTE ON/UNDER	Route On Structure					HBP FUNDING ELIGIBILITY	Not Eligible

IDENTIFICATION

(5B) ROUTE TYPE	County Hwy
(5C) SERVICE TYPE	Mainline
(5D) ROUTE NUMBER 00000	(5E) SUFFIX N/A (NBI)
(6A) FEATURE INTERSECTED	TRIB TO LOVEWELL RES.
(9) LOCATION	3 6N 7 0E OF BURR OAK
(16) LATITUDE	39 ° 55 ' 42.00 "
(17) LONGITUDE	98 ° 10 ' 24 00 "
(2) HIGHWAY AGENCY DISTRICT	Salina
(98A) BORDER BRIDGE STATE	Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY	%
(99) BORDER BRIDGE STRUCTURE NO	–
(7) (ROUTE NAME) FACILITY CARRIED	LOCAL Y 6-18.0

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE)000000000	(13B) LRS SUBRTE # 00
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	20
(109) AVERAGE DAILY TRUCK TRAFFIC	0 %
(30) YEAR OF ADT	2005
(27) YEAR BUILT	1935
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	1-lane Br for 2-way
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	1
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.730 MI

LOAD RATING

(66) INVENTORY LOAD RATING	18 ton, HS 9.00
(64) MAXIMUM LOAD RATING	25 ton, HS 13.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			06/03/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Unknown (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	FT
(94) BRIDGE COST	
(95) ROADWAY COST	
(96) TOTAL COST	
(97) COST ESTIMATE YEAR	
(114) FUTURE ADT	20
(115) FUTURE ADT YEAR	2024

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	29.9 FT
(48) MAXIMUM SPAN LENGTH	27.9 FT
(32) ROUTE WIDTH	15.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	15.1 FT
(52) DECK WIDTH OUT TO OUT	18.4 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	15.1 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	99.9 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Slab
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Gravel
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	7
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	7
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	63.50
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	32.12	1147	V_{RA} (m/s) =	2.19	7.20
y_0 (m) =	1.7202	5.64	A_{culv} (m^2) =	14.64	157.56
w_{culv} (m) =	8.5095	27.9	V_{CL} (m/s) =	2.02	6.63
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.87	6.13

y_{max} (m) =	4.23	Without wingwalls
y_{max} (m) =	3.29	With wingwalls
Conversion (ft)		
y_{max} (ft) =	13.89	Without wingwalls
y_{max} (ft) =	10.79	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1147
y_0 (ft) =	5.64
w_{culv} (ft) =	27.9
w_a (ft) =	35
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	9.58
A_{culv} (ft^2) =	157.356
V_{CN} (ft/s) =	7.24
y_2 (ft) =	7.47
q_1/q_2 =	0.80
x =	0.202

y_{max} (ft) =	11.31	Without wingwalls
y_{max} (ft) =	10.79	With wingwalls

Built = 1935

Bridge # = 000450731003104

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 3.5

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
180.00	141.90	1.81	1.39	1.99	3-M2t	6.16	0.93	1.80	1.80	2.82	3.59
360.00	286.36	2.81	2.22	3.09	3-M2t	10.00	1.49	2.80	2.80	3.67	4.62
540.00	431.90	3.66	2.92	4.02	3-M2t	10.00	1.96	3.64	3.64	4.26	5.32
720.00	578.60	4.42	3.55	4.85	3-M2t	10.00	2.38	4.40	4.39	4.72	5.87
900.00	726.91	5.13	4.13	5.63	3-M2t	10.00	2.77	5.10	5.10	5.11	6.32
1080.00	875.78	5.80	4.68	6.36	3-M2t	10.00	3.13	5.77	5.77	5.44	6.71
1260.00	1025.96	6.45	5.21	7.07	3-M2t	10.00	3.48	6.41	6.41	5.74	7.05
1440.00	1137.93	7.07	5.60	7.70	3-M2t	10.00	3.73	7.03	7.03	5.80	7.34
1620.00	1145.42	7.70	5.63	8.20	3-M2t	10.00	3.75	7.63	7.63	5.38	7.61
1674.00	1147.68	7.88	5.64	8.36	3-M2t	10.00	3.75	7.81	7.81	5.27	7.69

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000450733503100**	(1) STATE	**Kansas**	(4) CITY **Rural**	(3) COUNTY	**Jewell**
(5A) ROUTE ON/UNDER	**Route On Structure**				HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE	County Hwy
(5C) SERVICE TYPE	Mainline
(5D) ROUTE NUMBER 04514	(5E) SUFFIX N/A (NBI)
(6A) FEATURE INTERSECTED	TRIB. TO LOVEWELL RES.
(9) LOCATION	6.0W OF WEBBER
(16) LATITUDE	39 ° 55 ' 48.00 "
(17) LONGITUDE	98 ° 08 ' 48.00 "
(2) HIGHWAY AGENCY DISTRICT	Salina
(98A) BORDER BRIDGE STATE	Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY	%
(99) BORDER BRIDGE STRUCTURE NO.	_
(7) (ROUTE NAME) FACILITY CARRIED	MINOR Z-19.5

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural min Collector
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE)000000000	(13B) LRS SUBRTE # 00
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	55
(109) AVERAGE DAILY TRUCK TRAFFIC	0 %
(30) YEAR OF ADT	2005
(27) YEAR BUILT	1932
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	1-lane Br for 2-way
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.700 MI

LOAD RATING

(66) INVENTORY LOAD RATING	12 ton, HS 6.00
(64) MAXIMUM LOAD RATING	15 ton, HS 7.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	30.0-39.9%below
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			06/03/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Unknown (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	FT
(94) BRIDGE COST	
(95) ROADWAY COST	
(96) TOTAL COST	
(97) COST ESTIMATE YEAR	
(114) FUTURE ADT	55
(115) FUTURE ADT YEAR	2024

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	26.9 FT
(48) MAXIMUM SPAN LENGTH	24.9 FT
(32) ROUTE WIDTH	20.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	18.0 FT
(52) DECK WIDTH OUT TO OUT	21.0 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	17.7 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	99.9 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Gravel
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	8
(67) STRUCTURAL EVALUATION	4
(68) DECK WIDTH APPRAISAL	4
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	60.30
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


UIC 2011:07:19 15:08:15
208° SSW tru
W:098° 08' 46.752"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	17.67	631	V_{RA} (m/s) =	1.91	6.25
y_0 (m) =	1.22	4	A_{culv} (m^2) =	9.27	99.73
w_{culv} (m) =	7.5945	24.9	V_{CL} (m/s) =	1.88	6.18
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.23	4.05

y_{max} (m) =	2.80	Without wingwalls
y_{max} (m) =	2.17	With wingwalls
Conversion (ft)		
y_{max} (ft) =	9.17	Without wingwalls
y_{max} (ft) =	7.13	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	631
y_0 (ft) =	4
w_{culv} (ft) =	24.9
w_a (ft) =	30
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	8.51
A_{culv} (ft^2) =	99.6
V_{CN} (ft/s) =	6.69
y_2 (ft) =	5.08
q_1/q_2 =	0.83
x =	0.202

y_{max} (ft) =	7.70	Without wingwalls
y_{max} (ft) =	7.35	With wingwalls

Built = 1932

Bridge # = 000450733503100

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 3

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
120.00	94.21	1.52	1.14	1.67	3-M2t	5.34	0.76	1.51	1.51	2.51	3.20
240.00	190.92	2.36	1.83	2.58	3-M2t	7.00	1.22	2.34	2.34	3.28	4.13
360.00	288.70	3.06	2.41	3.36	3-M2t	7.00	1.61	3.04	3.04	3.82	4.76
480.00	386.99	3.70	2.93	4.05	3-M2t	7.00	1.96	3.67	3.67	4.24	5.26
600.00	486.11	4.29	3.41	4.69	3-M2t	7.00	2.28	4.25	4.25	4.59	5.67
720.00	581.18	4.85	3.86	5.29	3-M2t	7.00	2.57	4.81	4.80	4.86	6.02
840.00	592.85	5.41	3.91	5.74	3-M2t	7.00	2.61	5.34	5.33	4.46	6.32
960.00	613.77	6.01	4.01	6.21	3-M2t	7.00	2.67	5.85	5.85	4.22	6.60
1045.00	630.97	6.43	4.09	6.54	3-M2t	7.00	2.72	6.20	6.20	4.09	6.77
1200.00	658.26	7.16	4.21	7.13	3-M2t	7.00	2.80	6.82	6.82	3.87	7.06

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000560941805520**	(1) STATE	**Kansas**	(4) CITY **Rural**		(3) COUNTY	**Lyon**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			TRIB. TO TROUBLESOME RIV
(9) LOCATION			6.0S 1.7W OF OLPE
(16) LATITUDE			38 ° 10 ' 20.90 "
(17) LONGITUDE			96 ° 11 ' 53.00 "
(2) HIGHWAY AGENCY DISTRICT			Topeka
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			RD 10 941.8-552.0

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION		Rural Local
(104) NHS DESIGNATION		Not on NHS
(100) STRAHNET DESIGNATION		Not a STRAHNET hwy
(110) NATIONAL TRUCK NET		Not part of natl netwo
(12) BASE HIGHWAY NET		Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #	
(11) LRS MILE POINT		0.000 MI
(105) FEDERAL LANDS HIGHWAY		N/A (NBI)
(20) TOLL		Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY		County Hwy Agency
(22) OWNER		County Hwy Agency
(37) HISTORICAL SIGNIFICANCE		Possibly eligible for
(101) PARALLEL STRUCTURE		No || bridge exists
(103) TEMPORARY STRUCTURE		Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	54
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2007
(27) YEAR BUILT	1927
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.110 MI

LOAD RATING

(66) INVENTORY LOAD RATING	16 ton, HS 8.00
(64) MAXIMUM LOAD RATING	26 ton, HS 13.00
(31) DESIGN LOAD	5 MS 18 (HS 20)
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			03/30/2011
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	27.90 FT
(94) BRIDGE COST	$36000
(95) ROADWAY COST	$4000
(96) TOTAL COST	$54000
(97) COST ESTIMATE YEAR	2007
(114) FUTURE ADT	54
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	26.4 FT
(48) MAXIMUM SPAN LENGTH	24.9 FT
(32) ROUTE WIDTH	16.1 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	18.0 FT
(52) DECK WIDTH OUT TO OUT	19.0 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	16.4 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	99.9 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Gravel
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	5
(59) SUPERSTRUCTURE CONDITION	5
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	5

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	7
(71) WATERWAY ADEQUACY	7
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	4
(68) DECK WIDTH APPRAISAL	4
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	58.40
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

LYON COUNTY 2005
OFF SYSTEM 941.8-552.0

Prepared by: CKEC

↓ Looking W

↓ Looking E


JUL 11 2011
ESE mag
W:096°11'53.17"


JUL 11 2011
SW mag
W:096°11'52.75"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	13.27	474	V_{RA} (m/s) =	1.70	5.56
y_0 (m) =	1.0309	3.38	A_{culv} (m^2) =	7.83	84.27
w_{culv} (m) =	7.5945	24.9	V_{CL} (m/s) =	1.81	5.93
D_{50} (m) =	0.0254	0.083	y_2 (m) =	0.97	3.17

y_{max} (m) =	2.19	Without wingwalls
y_{max} (m) =	1.70	With wingwalls
Conversion (ft)		
y_{max} (ft) =	7.18	Without wingwalls
y_{max} (ft) =	5.58	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	474
y_0 (ft) =	3.38
w_{culv} (ft) =	24.9
w_a (ft) =	30
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	7.56
A_{culv} (ft^2) =	84.162
V_{CN} (ft/s) =	6.38
y_2 (ft) =	4.01
q_1/q_2 =	0.83
x =	0.202

y_{max} (ft) =	6.07	Without wingwalls
y_{max} (ft) =	5.79	With wingwalls

Built = 1927

Bridge # = 000560941805520

Channel Bottom= Gravel, silt, sand, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
120.00	105.10	1.82	1.23	1.95	3-M2t	5.57	0.82	1.82	1.82	2.32	3.48
240.00	212.23	2.86	1.96	3.04	3-M2t	7.00	1.31	2.85	2.85	2.99	4.43
360.00	320.64	3.75	2.58	3.99	3-M2t	7.00	1.73	3.74	3.74	3.44	5.07
480.00	422.51	4.57	3.10	4.83	3-M2t	7.00	2.08	4.55	4.55	3.73	5.56
600.00	435.87	5.36	3.17	5.53	3-M2t	7.00	2.12	5.31	5.31	3.30	5.95
720.00	441.06	6.11	3.19	6.21	3-M2t	7.00	2.14	6.04	6.04	2.93	6.28
840.00	451.49	6.87	3.24	6.89	3-M2t	7.00	2.17	6.74	6.74	2.69	6.56
960.00	464.13	7.63	3.30	7.58	4-FFf	7.00	2.21	7.00	7.43	2.66	6.80
1045.00	473.66	8.15	3.35	8.06	4-FFf	7.00	2.24	7.00	7.90	2.72	6.96
1200.00	508.67	9.07	3.51	8.93	4-FFf	7.00	2.35	7.00	8.75	2.92	7.22

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	000570831005209	(1) STATE	Kansas	(4) CITY	Rural	(3) COUNTY	Marion
(5A) ROUTE ON/UNDER	Route On Structure					HBP FUNDING ELIGIBILITY	Replacement

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			FRENCH CREEK
(9) LOCATION			1.5W 3.1N OF HILLSBORO
(16) LATITUDE			38 ° 23 ' 36.00 "
(17) LONGITUDE			97 ° 14 ' 30.00 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL RD. 79

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION		Rural Local
(104) NHS DESIGNATION		Not on NHS
(100) STRAHNET DESIGNATION		Not a STRAHNET hwy
(110) NATIONAL TRUCK NET		Not part of natl netwo
(12) BASE HIGHWAY NET		Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #	
(11) LRS MILE POINT		0.000 MI
(105) FEDERAL LANDS HIGHWAY		N/A (NBI)
(20) TOLL		Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY		County Hwy Agency
(22) OWNER		County Hwy Agency
(37) HISTORICAL SIGNIFICANCE		Possibly eligible for
(101) PARALLEL STRUCTURE		No || bridge exists
(103) TEMPORARY STRUCTURE		Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	35
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2007
(27) YEAR BUILT	1920
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	1-lane Br for 2-way
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	1.900 MI

LOAD RATING

(66) INVENTORY LOAD RATING	5 ton, HS 2.00
(64) MAXIMUM LOAD RATING	8 ton, HS 3.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	>39.9% below
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			11/03/2010
(91) ROUTINE INSPECTION FREQUENCY			12 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Repl-Load Capacity
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	43.00 FT
(94) BRIDGE COST	$100000
(95) ROADWAY COST	$100000
(96) TOTAL COST	$205000
(97) COST ESTIMATE YEAR	2008
(114) FUTURE ADT	35
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	23.0 FT
(48) MAXIMUM SPAN LENGTH	22.0 FT
(32) ROUTE WIDTH	20.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	16.1 FT
(52) DECK WIDTH OUT TO OUT	18.0 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	8.0 °
(47) ROUTE HORIZONTAL CLEARANCE	15.8 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Slab
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Gravel
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	4
(59) SUPERSTRUCTURE CONDITION	4
(60) SUBSTRUCTURE CONDITION	3
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	3

APPRAISAL

DEFICIENCY STATUS	Structurally Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	5
(113) SCOUR VULNERABILITY	4
(67) STRUCTURAL EVALUATION	2
(68) DECK WIDTH APPRAISAL	3
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	20.40
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


2011/ 9/13


2011/ 9/13

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	7.29	260.3	V_{RA} (m/s) =	1.44	4.73
y_0 (m) =	0.75335	2.47	A_{culv} (m^2) =	5.05	54.41
w_{culv} (m) =	6.71	22	V_{CL} (m/s) =	1.69	5.55
D_{50} (m) =	0.0254	0.083	y_2 (m) =	0.64	2.11

y_{max} (m) =	1.46	Without wingwalls
y_{max} (m) =	1.13	With wingwalls
Conversion (ft)		
y_{max} (ft) =	4.77	Without wingwalls
y_{max} (ft) =	3.71	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	260.3
y_0 (ft) =	2.47
w_{culv} (ft) =	22
w_a (ft) =	30
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	6.18
A_{culv} (ft^2) =	54.34
V_{CN} (ft/s) =	5.85
y_2 (ft) =	2.61
q_1/q_2 =	0.73
x =	0.202

y_{max} (ft) =	3.95	Without wingwalls
y_{max} (ft) =	3.77	With wingwalls

Built = 1920

Bridge # = 000570831005209

Channel Bottom= Gravel, silt, sand, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
55.00	40.27	1.04	0.70	1.04	3-M2t	3.17	0.47	0.93	0.93	1.97	2.70
110.00	87.94	1.62	1.18	1.62	3-M2t	4.00	0.79	1.43	1.43	2.80	3.51
165.00	123.66	2.06	1.49	2.06	3-M2t	4.00	1.00	1.84	1.84	3.05	4.07
220.00	165.95	2.48	1.81	2.48	3-M2t	4.00	1.21	2.22	2.21	3.40	4.52
275.00	208.46	2.86	2.11	2.86	3-M2t	4.00	1.41	2.56	2.56	3.70	4.89
330.00	236.28	3.18	2.31	3.18	3-M2t	4.00	1.53	2.88	2.88	3.73	5.21
385.00	240.13	3.44	2.33	3.44	3-M2t	4.00	1.55	3.19	3.19	3.42	5.49
440.00	247.26	3.70	2.38	3.70	3-M2t	4.00	1.58	3.48	3.48	3.23	5.74
495.00	255.69	3.97	2.44	3.97	3-M2t	4.00	1.62	3.77	3.77	3.08	5.97
528.00	260.33	4.12	2.47	4.12	3-M2t	4.00	1.64	3.93	3.93	3.01	6.10

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	000570859305387	(1) STATE	Kansas	(4) CITY	Rural	(3) COUNTY	Marion
(5A) ROUTE ON/UNDER	Route On Structure					HBP FUNDING ELIGIBILITY	Not Eligible

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			CATLIN CREEK
(9) LOCATION			1.9W 1.3N OF FLORENCE
(16) LATITUDE			38 ° 15 ' 48.00 "
(17) LONGITUDE			96 ° 58 ' 48.00 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL RD. 214

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	40
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2005
(27) YEAR BUILT	1945
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	1.860 MI

LOAD RATING

(66) INVENTORY LOAD RATING	26 ton, HS 13.00
(64) MAXIMUM LOAD RATING	43 ton, HS 23.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	LF Load Factor
(63) OPERATING (MAX) LOAD RATING METHOD	LF Load Factor
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posting Recommended

SCHEDULE

(90) ROUTINEINSPECTION DATE			10/26/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Unknown (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	FT
(94) BRIDGE COST	
(95) ROADWAY COST	
(96) TOTAL COST	
(97) COST ESTIMATE YEAR	
(114) FUTURE ADT	40
(115) FUTURE ADT YEAR	2027

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	45.0 FT
(48) MAXIMUM SPAN LENGTH	41.0 FT
(32) ROUTE WIDTH	24.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	20.0 FT
(52) DECK WIDTH OUT TO OUT	22.6 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	19.7 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Stringer/Girder
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	6
(68) DECK WIDTH APPRAISAL	5
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	82.20
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


NNW mag
W:096°58' 49.47"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 4

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	46.14	1648	V_{RA} (m/s) =	2.17	7.11
y_0 (m) =	1.7019	5.58	A_{culv} (m^2) =	21.28	229.08
w_{culv} (m) =	12.505	41	V_{CL} (m/s) =	2.99	9.81
D_{50} (m) =	0.1017	0.333	y_2 (m) =	1.23	4.05

y_{max} (m) =	2.79	Without wingwalls
y_{max} (m) =	2.17	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	9.17	Without wingwalls
y_{max} (ft) =	7.13	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{U1} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1648
y_0 (ft) =	5.58
w_{culv} (ft) =	41
w_a (ft) =	50
D_{50} (ft) =	0.333

Outputs	
V_{RM} (ft/s) =	9.60
A_{culv} (ft^2) =	228.78
V_{CN} (ft/s) =	10.11
y_2 (ft) =	5.30
q_1/q_2 =	0.82
x =	0.153

y_{max} (ft) =	8.03	Without wingwalls
y_{max} (ft) =	7.66	With wingwalls

Built = 1945

Bridge # = 000570859305387

Channel Bottom= Boulders and Cobbles

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
240.00	174.95	1.56	1.24	1.73	3-M2t	5.61	0.83	1.54	1.54	2.78	3.81
480.00	353.22	2.41	1.98	2.67	3-M2t	9.00	1.32	2.36	2.36	3.64	4.95
720.00	531.64	3.11	2.59	3.44	3-M2t	9.00	1.74	3.05	3.05	4.25	5.76
960.00	711.95	3.73	3.15	4.14	3-M2t	9.00	2.11	3.66	3.66	4.74	6.39
1200.00	889.93	4.30	3.66	4.77	3-M2t	9.00	2.45	4.23	4.23	5.13	6.92
1440.00	1069.46	4.84	4.13	5.37	3-M2t	9.00	2.77	4.76	4.75	5.49	7.39
1680.00	1249.30	5.35	4.59	5.94	3-M2t	9.00	3.07	5.26	5.26	5.80	7.80
1920.00	1432.26	5.84	5.05	6.49	3-M2t	9.00	3.37	5.74	5.74	6.09	8.16
2160.00	1610.99	6.31	5.49	7.01	3-M2t	9.00	3.64	6.20	6.20	6.34	8.50
2214.00	1648.14	6.42	5.58	7.12	3-M2t	9.00	3.70	6.30	6.30	6.38	8.57

010290

Bridge Inventory & Appraisal (English

(8) STRUCTURE NO	000590759004940	(1) STATE	Kansas	(4) CITY	Rural	(3) COUNTY	McPherson
(5A) ROUTE ON/UNDER	Route On Structure					HBP FUNDING ELIGIBILITY	Not Eligible

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	05926	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			TRIB. SMOKY HILL RIVER
(9) LOCATION			2.6N 4.0W OF MARQUETTE
(16) LATITUDE			38 ° 35 ' 47.46 "
(17) LONGITUDE			97 ° 54 ' 21.80 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			WHEATRIDGE RD.

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION		Rural min Collector
(104) NHS DESIGNATION		Not on NHS
(100) STRAHNET DESIGNATION		Not a STRAHNET hwy
(110) NATIONAL TRUCK NET		Not part of natl netwo
(12) BASE HIGHWAY NET		Unknown (NBI)
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #	
(11) LRS MILE POINT		0.000 MI
(105) FEDERAL LANDS HIGHWAY		N/A (NBI)
(20) TOLL		Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY		County Hwy Agency
(22) OWNER		County Hwy Agency
(37) HISTORICAL SIGNIFICANCE		Hist sign not determin
(101) PARALLEL STRUCTURE		No || bridge exists
(103) TEMPORARY STRUCTURE		Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	58
(109) AVERAGE DAILY TRUCK TRAFFIC	6 %
(30) YEAR OF ADT	2008
(27) YEAR BUILT	1932
(106) YEAR REHABILITATED	1960
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	9.900 MI

LOAD RATING

(66) INVENTORY LOAD RATING	18 ton, HS 9.00
(64) MAXIMUM LOAD RATING	24 ton, HS 12.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	No rating
(63) OPERATING (MAX) LOAD RATING METHOD	No rating
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			12/27/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Not Applicable (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	40.00 FT
(94) BRIDGE COST	$130000
(95) ROADWAY COST	$10000
(96) TOTAL COST	$155000
(97) COST ESTIMATE YEAR	2008
(114) FUTURE ADT	87
(115) FUTURE ADT YEAR	2030

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	40.0 FT
(48) MAXIMUM SPAN LENGTH	39.0 FT
(32) ROUTE WIDTH	22.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	26.2 FT
(52) DECK WIDTH OUT TO OUT	26.2 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	10.0 °
(47) ROUTE HORIZONTAL CLEARANCE	24.0 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	99.9 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Bituminous
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	7
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	4
(113) SCOUR VULNERABILITY	8
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	6
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	62.70
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

Printed: 7/15/2011

KDOT BLP SIA Single WN v5.0 9/10/2009


NW mag
W:097°54'22.96"


ENE mag

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)
Q (m^3/s) =	35.20	1257
y_0 (m) =	1.65005	5.41
w_{culv} (m) =	11.895	39
D_{50} (m) =	0.0254	0.083

Outputs		Conversion (ft)
V_{RA} (m/s) =	1.79	5.88
A_{culv} (m^2) =	19.63	211.27
V_{CL} (m/s) =	1.95	6.40
y_2 (m) =	1.52	4.97

y_{max} (m) =	3.44	Without wingwalls
y_{max} (m) =	2.67	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	11.27	Without wingwalls
y_{max} (ft) =	8.76	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1257
y_0 (ft) =	5.41
w_{culv} (ft) =	39
w_a (ft) =	48
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	7.90
A_{culv} (ft^2) =	210.99
V_{CN} (ft/s) =	6.96
y_2 (ft) =	6.14
q_1/q_2 =	0.81
x =	0.202

y_{max} (ft) =	9.30	Without wingwalls
y_{max} (ft) =	8.88	With wingwalls

Built = 1932

Bridge # = 000590759004940

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
195.00	134.79	1.43	1.26	1.59	3-M2t	5.15	0.72	1.40	1.40	2.47	3.58
390.00	272.12	2.19	1.99	2.45	3-M2t	8.00	1.15	2.15	2.15	3.25	4.66
585.00	410.88	2.83	2.60	3.16	3-M2t	8.00	1.51	2.77	2.77	3.80	5.42
780.00	548.17	3.40	3.15	3.79	3-M2t	8.00	1.83	3.32	3.32	4.23	6.02
975.00	687.55	3.92	3.67	4.38	3-M2t	8.00	2.13	3.83	3.83	4.60	6.52
1170.00	824.57	4.41	4.12	4.93	3-M2t	8.00	2.41	4.31	4.31	4.90	6.96
1365.00	962.96	4.88	4.56	5.45	3-M2t	8.00	2.67	4.76	4.76	5.18	7.35
1560.00	1101.94	5.32	4.97	5.94	3-M2t	8.00	2.92	5.20	5.20	5.43	7.70
1755.00	1225.35	5.76	5.32	6.40	3-M2t	8.00	3.14	5.62	5.62	5.59	8.01
1872.00	1257.37	6.06	5.41	6.62	3-M2t	8.00	3.19	5.86	5.86	5.50	8.19

181250

Bridge Inventory & Appraisal (Englis

(8) STRUCTURE NO	000590793105020	(1) STATE	Kansas	(4) CITY	Rural	(3) COUNTY	McPherson
(5A) ROUTE ON/UNDER	Route On Structure					HBP FUNDING ELIGIBILITY	Rehabilitation

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			EAST KENTUCKY CREEK
(9) LOCATION			2.5S 4.6E OF LINDSBORG
(16) LATITUDE			38 ° 32 ' 11.05 "
(17) LONGITUDE			97 ° 35 ' 28.86 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			SIOUX RD.

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Unknown (NBI)
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	45
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2005
(27) YEAR BUILT	1924
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.730 MI

LOAD RATING

(66) INVENTORY LOAD RATING	20 ton, HS 10.00
(64) MAXIMUM LOAD RATING	27 ton, HS 14.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	No rating
(63) OPERATING (MAX) LOAD RATING METHOD	No rating
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			10/29/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	21.00 FT
(94) BRIDGE COST	$55000
(95) ROADWAY COST	$10000
(96) TOTAL COST	$75000
(97) COST ESTIMATE YEAR	2008
(114) FUTURE ADT	55
(115) FUTURE ADT YEAR	2030

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	21.0 FT
(48) MAXIMUM SPAN LENGTH	21.0 FT
(32) ROUTE WIDTH	22.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	16.1 FT
(52) DECK WIDTH OUT TO OUT	18.0 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	16.1 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	99.9 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Slab
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Other
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	8
(59) SUPERSTRUCTURE CONDITION	8
(60) SUBSTRUCTURE CONDITION	7
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Functionally Obsolete
(72) BRIDGE ROUTE ALIGNMENT	7
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	8
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	3
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	61.70
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


SEP 8 2011
SE mag
W:097°35'28.59"


SEP 8 2011
SSW mag

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	25.79	921	V_{RA} (m/s) =	2.24	7.34
y_0 (m) =	1.7995	5.9	A_{culv} (m^2) =	11.53	124.06
w_{culv} (m) =	6.405	21	V_{CL} (m/s) =	2.04	6.69
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.98	6.48

y_{max} (m) =	4.48	Without wingwalls
y_{max} (m) =	3.48	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	14.68	Without wingwalls
y_{max} (ft) =	11.41	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	921
y_0 (ft) =	5.9
w_{culv} (ft) =	21
w_a (ft) =	30
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	9.55
A_{culv} (ft^2) =	123.9
V_{CN} (ft/s) =	7.29
y_2 (ft) =	7.73
q_1/q_2 =	0.70
x =	0.202

y_{max} (ft) =	11.71	Without wingwalls
y_{max} (ft) =	11.18	With wingwalls

Built = 1924

Bridge # = 000590793105020

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
135.00	101.74	1.70	1.35	1.88	3-M2t	6.17	0.90	1.68	1.68	2.89	3.84
270.00	206.47	2.65	2.16	2.93	3-M2t	10.00	1.45	2.62	2.62	3.76	4.92
405.00	312.86	3.46	2.85	3.82	3-M2t	10.00	1.91	3.42	3.42	4.36	5.65
540.00	420.44	4.19	3.46	4.63	3-M2t	10.00	2.32	4.14	4.14	4.83	6.21
675.00	529.60	4.88	4.04	5.38	3-M2t	10.00	2.71	4.83	4.82	5.23	6.66
810.00	639.57	5.53	4.58	6.10	3-M2t	10.00	3.07	5.47	5.47	5.56	7.05
945.00	751.11	6.16	5.11	6.79	3-M2t	10.00	3.42	6.10	6.10	5.87	7.38
1080.00	863.43	6.76	5.63	7.45	3-M2t	10.00	3.75	6.70	6.70	6.14	7.68
1215.00	915.08	7.37	5.87	8.00	3-M2t	10.00	3.90	7.29	7.29	5.98	7.94
1260.00	921.19	7.59	5.90	8.16	3-M2t	10.00	3.92	7.48	7.48	5.86	8.02

268250

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	000590809805020	(1) STATE	Kansas	(4) CITY	Rural	(3) COUNTY	McPherson
(5A) ROUTE ON/UNDER	Route On Structure					HBP FUNDING ELIGIBILITY	Rehabilitation

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			TRIB. TO GYPSUM CREEK
(9) LOCATION			0.2W 10.4N OF CANTON
(16) LATITUDE			38 ° 32 ' 11.07 "
(17) LONGITUDE			97 ° 25 ' 52.07 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			SIOUX RD.

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION			Rural Local
(104) NHS DESIGNATION			Not on NHS
(100) STRAHNET DESIGNATION			Not a STRAHNET hwy
(110) NATIONAL TRUCK NET			Not part of natl netwo
(12) BASE HIGHWAY NET			Unknown (NBI)
(13A) LRS INVENTORY ROUTE		(13B) LRS SUBRTE #	
(11) LRS MILE POINT			0.000 MI
(105) FEDERAL LANDS HIGHWAY			N/A (NBI)
(20) TOLL			Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY			County Hwy Agency
(22) OWNER			County Hwy Agency
(37) HISTORICAL SIGNIFICANCE			Possibly eligible for
(101) PARALLEL STRUCTURE			No || bridge exists
(103) TEMPORARY STRUCTURE			Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	20
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2005
(27) YEAR BUILT	1934
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.700 MI

LOAD RATING

(66) INVENTORY LOAD RATING	21 ton, HS 11.00
(64) MAXIMUM LOAD RATING	29 ton, HS 15.00
(31) DESIGN LOAD	0 Other or Unknown
(65) INVENTORY LOAD RATING METHOD	No rating
(63) OPERATING (MAX) LOAD RATING METHOD	No rating
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for load

SCHEDULE

(90) ROUTINEINSPECTION DATE			05/23/2011
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Repl-Load Capacity
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	27.90 FT
(94) BRIDGE COST	$39000
(95) ROADWAY COST	$4000
(96) TOTAL COST	$58000
(97) COST ESTIMATE YEAR	2008
(114) FUTURE ADT	24
(115) FUTURE ADT YEAR	2030

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	27.9 FT
(48) MAXIMUM SPAN LENGTH	26.9 FT
(32) ROUTE WIDTH	22.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	17.7 FT
(52) DECK WIDTH OUT TO OUT	20.3 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	17.4 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	99.9 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Other
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	5
(59) SUPERSTRUCTURE CONDITION	5
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Functionally Obsolete
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	8
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	3
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	59.80
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


AUG 17 2011


AUG 17 2011

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	16.53	590.3	V_{RA} (m/s) =	1.77	5.81
y_0 (m) =	1.13765	3.73	A_{culv} (m^2) =	9.33	100.47
w_{culv} (m) =	8.2045	26.9	V_{CL} (m/s) =	1.85	6.06
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.09	3.58

y_{max} (m) =	2.47	Without wingwalls
y_{max} (m) =	1.92	With wingwalls
Conversion (ft)		
y_{max} (ft) =	8.11	Without wingwalls
y_{max} (ft) =	6.30	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	590.3
y_0 (ft) =	3.73
w_{culv} (ft) =	26.9
w_a (ft) =	35
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	7.65
A_{culv} (ft^2) =	100.337
V_{CN} (ft/s) =	6.50
y_2 (ft) =	4.39
q_1/q_2 =	0.77
x =	0.202

y_{max} (ft) =	6.65	Without wingwalls
y_{max} (ft) =	6.34	With wingwalls

Built = 1934

Bridge # = 000590809805020

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
100.00	70.73	1.19	0.90	1.33	3-M2t	4.50	0.60	1.18	1.18	2.24	3.16
200.00	145.05	1.83	1.45	2.04	3-M2t	6.00	0.97	1.81	1.81	2.97	4.10
300.00	220.33	2.37	1.91	2.64	3-M2t	6.00	1.28	2.34	2.34	3.49	4.76
400.00	296.22	2.85	2.33	3.17	3-M2t	6.00	1.56	2.82	2.82	3.91	5.27
500.00	372.17	3.29	2.71	3.66	3-M2t	6.00	1.82	3.26	3.26	4.25	5.71
600.00	449.82	3.71	3.08	4.12	3-M2t	6.00	2.06	3.67	3.67	4.56	6.08
700.00	525.79	4.11	3.44	4.56	3-M2t	6.00	2.29	4.06	4.06	4.81	6.41
800.00	556.97	4.51	3.58	4.90	3-M2t	6.00	2.38	4.44	4.44	4.67	6.70
900.00	575.90	4.94	3.66	5.22	3-M2t	6.00	2.43	4.80	4.80	4.46	6.97
968.40	590.27	5.23	3.73	5.44	3-M2t	6.00	2.47	5.04	5.04	4.35	7.14


2010/ 2/23

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 2

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	37.66	1345	V_{RA} (m/s) =	2.36	7.75
y_0 (m) =	2.01	6.59	A_{culv} (m^2) =	15.94	171.57
w_{culv} (m) =	7.93	26	V_{CL} (m/s) =	2.54	8.35
D_{50} (m) =	0.0508	0.167	y_2 (m) =	1.87	6.12

y_{max} (m) =	4.23	Without wingwalls
y_{max} (m) =	3.29	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	13.87	Without wingwalls
y_{max} (ft) =	10.78	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1345
y_0 (ft) =	6.59
w_{culv} (ft) =	26
w_a (ft) =	35
D_{50} (ft) =	0.167

Outputs	
V_{RM} (ft/s) =	10.14
A_{culv} (ft^2) =	171.34
V_{CN} (ft/s) =	8.78
y_2 (ft) =	7.61
q_1/q_2 =	0.74
x =	0.176

y_{max} (ft) =	11.53	Without wingwalls
y_{max} (ft) =	11.00	With wingwalls

Built = 1930

Bridge # = 000611067405000

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 3

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
190.00	143.18	1.82	1.47	2.01	3-M2t	6.12	0.98	1.80	1.80	3.06	4.07
380.00	288.39	2.82	2.34	3.13	3-M2t	11.00	1.57	2.80	2.79	3.97	5.23
570.00	435.25	3.68	3.08	4.07	3-M2t	11.00	2.06	3.64	3.64	4.60	6.02
760.00	594.76	4.44	3.79	4.95	3-M2t	11.00	2.54	4.40	4.40	5.20	6.64
950.00	733.20	5.16	4.35	5.72	3-M2t	11.00	2.92	5.12	5.12	5.51	7.14
1140.00	884.18	5.85	4.93	6.47	3-M2t	11.00	3.31	5.79	5.79	5.87	7.57
1330.00	1036.60	6.50	5.48	7.19	3-M2t	11.00	3.68	6.44	6.44	6.19	7.95
1520.00	1190.46	7.13	6.04	7.89	3-M2t	11.00	4.03	7.06	7.06	6.48	8.28
1710.00	1344.69	7.74	6.59	8.56	3-M2t	11.00	4.37	7.67	7.67	6.74	8.57
1716.00	1345.45	7.76	6.59	8.58	3-M2t	11.00	4.37	7.69	7.69	6.73	8.58

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000640879504966**	(1) STATE	**Kansas**	(4) CITY **Rural**		(3) COUNTY	**Morris**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			SIX MILE CREEK
(9) LOCATION			3.0E 0.5N OF BURDICK
(16) LATITUDE			38 ° 34 ' 18.00 "
(17) LONGITUDE			96 ° 47 ' 24.00 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL 80 AA.6-2450

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION			Rural Local
(104) NHS DESIGNATION			Not on NHS
(100) STRAHNET DESIGNATION			Not a STRAHNET hwy
(110) NATIONAL TRUCK NET			Not part of natl netwo
(12) BASE HIGHWAY NET			Not on Base Network
(13A) LRS INVENTORY ROUTE		(13B) LRS SUBRTE #	
(11) LRS MILE POINT			0.000 MI
(105) FEDERAL LANDS HIGHWAY			N/A (NBI)
(20) TOLL			Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY			County Hwy Agency
(22) OWNER			County Hwy Agency
(37) HISTORICAL SIGNIFICANCE			Not eligible for NRHP
(101) PARALLEL STRUCTURE			No || bridge exists
(103) TEMPORARY STRUCTURE			Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	50
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2008
(27) YEAR BUILT	1970
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	8.100 MI

LOAD RATING

(66) INVENTORY LOAD RATING	23 ton, HS 12.00
(64) MAXIMUM LOAD RATING	27 ton, HS 14.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	No rating
(63) OPERATING (MAX) LOAD RATING METHOD	No rating
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for Non-Load

SCHEDULE

(90) ROUTINEINSPECTION DATE			11/19/2009
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Not Applicable (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	FT
(94) BRIDGE COST	
(95) ROADWAY COST	
(96) TOTAL COST	
(97) COST ESTIMATE YEAR	
(114) FUTURE ADT	60
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	40.0 FT
(48) MAXIMUM SPAN LENGTH	38.1 FT
(32) ROUTE WIDTH	24.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	24.0 FT
(52) DECK WIDTH OUT TO OUT	24.6 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	23.6 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Prestressed Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Bituminous
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	7
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	4
(67) STRUCTURAL EVALUATION	5
(68) DECK WIDTH APPRAISAL	6
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	72.90
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


2011/ 7/26
S mag
W:096°47'29.50"


2011/ 7/26
S mag
W:096°47'29.58"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	37.72	1347	V_{RA} (m/s) =	2.07	6.80
y_0 (m) =	1.56465	5.13	A_{culv} (m^2) =	18.18	195.71
w_{culv} (m) =	11.6205	38.1	V_{CL} (m/s) =	1.98	6.48
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.64	5.39

y_{max} (m) =	3.72	Without wingwalls
y_{max} (m) =	2.89	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	12.20	Without wingwalls
y_{max} (ft) =	9.49	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1347
y_0 (ft) =	5.13
w_{culv} (ft) =	38.1
w_a (ft) =	46
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	9.24
A_{culv} (ft^2) =	195.453
V_{CN} (ft/s) =	7.08
y_2 (ft) =	6.70
q_1/q_2 =	0.83
x =	0.202

y_{max} (ft) =	10.14	Without wingwalls
y_{max} (ft) =	9.68	With wingwalls

Built = 1970

Bridge # = 000640879504966

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 3

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
195.00	143.93	1.46	1.14	1.61	3-M2t	5.36	0.76	1.42	1.42	2.66	3.61
390.00	291.48	2.24	1.83	2.47	3-M2t	8.00	1.22	2.18	2.18	3.51	4.70
585.00	439.66	2.90	2.40	3.19	3-M2t	8.00	1.61	2.81	2.81	4.10	5.46
780.00	588.12	3.48	2.91	3.83	3-M2t	8.00	1.95	3.38	3.38	4.57	6.06
975.00	736.70	4.01	3.39	4.42	3-M2t	8.00	2.27	3.90	3.90	4.96	6.57
1170.00	885.40	4.52	3.83	4.97	3-M2t	8.00	2.57	4.38	4.38	5.30	7.00
1365.00	1034.90	4.99	4.26	5.50	3-M2t	8.00	2.85	4.85	4.85	5.60	7.39
1560.00	1185.84	5.44	4.69	6.00	3-M2t	8.00	3.12	5.29	5.29	5.88	7.74
1755.00	1325.00	5.89	5.07	6.47	3-M2t	8.00	3.36	5.72	5.72	6.08	8.06
1828.00	1347.31	6.09	5.13	6.61	3-M2t	8.00	3.39	5.87	5.87	6.02	8.17

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000640889204800**	(1) STATE	**Kansas**	(4) CITY **Rural**		(3) COUNTY	**Morris**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			HAUN CREEK
(9) LOCATION			4.0N 1.8W OF WILSEY
(16) LATITUDE			38 ° 41 ' 42.00 "
(17) LONGITUDE			96 ° 42 ' 12.00 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL 105 Q.0-1990

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION		Rural Local
(104) NHS DESIGNATION		Not on NHS
(100) STRAHNET DESIGNATION		Not a STRAHNET hwy
(110) NATIONAL TRUCK NET		Not part of natl netwo
(12) BASE HIGHWAY NET		Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #	
(11) LRS MILE POINT		0.000 MI
(105) FEDERAL LANDS HIGHWAY		N/A (NBI)
(20) TOLL		Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY		County Hwy Agency
(22) OWNER		County Hwy Agency
(37) HISTORICAL SIGNIFICANCE		Not eligible for NRHP
(101) PARALLEL STRUCTURE		No || bridge exists
(103) TEMPORARY STRUCTURE		Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	50
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2008
(27) YEAR BUILT	1965
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	3.700 MI

LOAD RATING

(66) INVENTORY LOAD RATING	23 ton, HS 12.00
(64) MAXIMUM LOAD RATING	27 ton, HS 14.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	No rating
(63) OPERATING (MAX) LOAD RATING METHOD	No rating
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for Non-Load

SCHEDULE

(90) ROUTINEINSPECTION DATE			12/01/2009
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Not Applicable (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	FT
(94) BRIDGE COST	
(95) ROADWAY COST	
(96) TOTAL COST	
(97) COST ESTIMATE YEAR	
(114) FUTURE ADT	60
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	40.0 FT
(48) MAXIMUM SPAN LENGTH	37.1 FT
(32) ROUTE WIDTH	24.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	24.0 FT
(52) DECK WIDTH OUT TO OUT	24.6 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	24.0 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Prestressed Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Gravel
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	7
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	6
(68) DECK WIDTH APPRAISAL	6
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	84.00
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

Bridge No. OS-105 7/30/91

Roadway Looking East

Sideview Looking North


2011/ 8/ 2


2011/ 8/ 2

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	32.37	1156	V_{RA} (m/s) =	1.77	5.79
y_0 (m) =	1.61955	5.31	A_{culv} (m^2) =	18.33	197.26
w_{culv} (m) =	11.3155	37.1	V_{CL} (m/s) =	1.94	6.37
D_{50} (m) =	0.0254	0.083	y_2 (m) =	1.47	4.83

y_{max} (m) =	3.34	Without wingwalls
y_{max} (m) =	2.60	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	10.95	Without wingwalls
y_{max} (ft) =	8.51	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1156
y_0 (ft) =	5.31
w_{culv} (ft) =	37.1
w_a (ft) =	45
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	7.84
A_{culv} (ft^2) =	197.001
V_{CN} (ft/s) =	6.93
y_2 (ft) =	6.01
q_1/q_2 =	0.82
x =	0.202

y_{max} (ft) =	9.11	Without wingwalls
y_{max} (ft) =	8.69	With wingwalls

Built = 1965

Bridge # = 000640889204800

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
210.00	171.47	1.87	1.51	2.04	3-M2t	6.14	0.87	1.86	1.86	2.48	4.17
420.00	346.00	2.92	2.41	3.17	3-M2t	9.00	1.40	2.89	2.89	3.22	5.36
630.00	521.27	3.80	3.15	4.13	3-M2t	9.00	1.83	3.77	3.77	3.73	6.17
840.00	698.33	4.59	3.83	4.99	3-M2t	9.00	2.23	4.56	4.56	4.13	6.80
1050.00	876.96	5.33	4.45	5.80	3-M2t	9.00	2.59	5.29	5.29	4.46	7.32
1260.00	1048.48	6.04	4.99	6.55	3-M2t	9.00	2.92	5.99	5.99	4.72	7.76
1470.00	1062.09	6.75	5.03	7.12	3-M2t	9.00	2.95	6.66	6.66	4.30	8.14
1680.00	1095.09	7.49	5.13	7.71	3-M2t	9.00	3.01	7.31	7.31	4.04	8.48
1890.00	1136.56	8.24	5.26	8.31	3-M2t	9.00	3.08	7.94	7.94	3.86	8.79
2003.00	1156.37	8.62	5.31	8.62	3-M2t	9.00	3.12	8.27	8.27	3.77	8.94

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000640915904880**	(1) STATE	**Kansas**	(4) CITY **Rural**		(3) COUNTY	**Morris**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE			County Hwy
(5C) SERVICE TYPE			Mainline
(5D) ROUTE NUMBER	00000	(5E) SUFFIX	N/A (NBI)
(6A) FEATURE INTERSECTED			LITTLE JOHN CREEK
(9) LOCATION			1.6S 1.9E COUNCIL GROVE
(16) LATITUDE			38 ° 38 ' 18.00 "
(17) LONGITUDE			96 ° 25 ' 48.00 "
(2) HIGHWAY AGENCY DISTRICT			Salina
(98A) BORDER BRIDGE STATE			Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY			%
(99) BORDER BRIDGE STRUCTURE NO.			_
(7) (ROUTE NAME) FACILITY CARRIED			LOCAL 69 V.0-510

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION			Rural Local
(104) NHS DESIGNATION			Not on NHS
(100) STRAHNET DESIGNATION			Not a STRAHNET hwy
(110) NATIONAL TRUCK NET			Not part of natl netwo
(12) BASE HIGHWAY NET			Not on Base Network
(13A) LRS INVENTORY ROUTE		(13B) LRS SUBRTE #	
(11) LRS MILE POINT			0.000 MI
(105) FEDERAL LANDS HIGHWAY			N/A (NBI)
(20) TOLL			Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY			County Hwy Agency
(22) OWNER			County Hwy Agency
(37) HISTORICAL SIGNIFICANCE			Possibly eligible for
(101) PARALLEL STRUCTURE			No || bridge exists
(103) TEMPORARY STRUCTURE			Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	50
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2008
(27) YEAR BUILT	1930
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	1-lane Br for 2-way
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	1
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	6.200 MI

LOAD RATING

(66) INVENTORY LOAD RATING	23 ton, HS 12.00
(64) MAXIMUM LOAD RATING	27 ton, HS 14.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	No rating
(63) OPERATING (MAX) LOAD RATING METHOD	No rating
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for Non-Load

SCHEDULE

(90) ROUTINEINSPECTION DATE			01/20/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	140.10 FT
(94) BRIDGE COST	$28000
(95) ROADWAY COST	$3000
(96) TOTAL COST	$42000
(97) COST ESTIMATE YEAR	2005
(114) FUTURE ADT	60
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	32.8 FT
(48) MAXIMUM SPAN LENGTH	30.0 FT
(32) ROUTE WIDTH	16.1 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	15.8 FT
(52) DECK WIDTH OUT TO OUT	19.4 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	30.0 °
(47) ROUTE HORIZONTAL CLEARANCE	15.7 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Slab
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	6
(59) SUPERSTRUCTURE CONDITION	6
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	6
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	6
(68) DECK WIDTH APPRAISAL	8
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	75.20
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


2011/ 7/15


2011/ 7/15
ENE mag
W:096°25' 46. 15"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 2

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	38.58	1378	V_{RA} (m/s) =	2.30	7.56
y_0 (m) =	1.83	6	A_{culv} (m^2) =	16.74	180.24
w_{culv} (m) =	9.15	30	V_{CL} (m/s) =	2.50	8.20
D_{50} (m) =	0.0508	0.167	y_2 (m) =	1.69	5.53

y_{max} (m) =	3.82	Without wingwalls
y_{max} (m) =	2.97	With wingwalls
Conversion (ft)		
y_{max} (ft) =	12.53	Without wingwalls
y_{max} (ft) =	9.74	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{U1} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1378
y_0 (ft) =	6
w_{culv} (ft) =	30
w_a (ft) =	40
D_{50} (ft) =	0.167

Outputs	
V_{RM} (ft/s) =	9.90
A_{culv} (ft^2) =	180
V_{CN} (ft/s) =	8.63
y_2 (ft) =	6.89
q_1/q_2 =	0.75
x =	0.176

y_{max} (ft) =	10.43	Without wingwalls
y_{max} (ft) =	9.96	With wingwalls

Built = 1930

Bridge # = 000640915904880

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 3

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
195.00	144.69	1.68	1.34	1.86	3-M2t	5.99	0.90	1.66	1.66	2.91	3.92
390.00	292.46	2.60	2.15	2.88	3-M2t	10.00	1.44	2.57	2.57	3.80	5.07
585.00	439.85	3.37	2.81	3.74	3-M2t	10.00	1.89	3.33	3.33	4.40	5.86
780.00	588.74	4.07	3.42	4.51	3-M2t	10.00	2.29	4.02	4.02	4.89	6.47
975.00	738.94	4.71	3.98	5.23	3-M2t	10.00	2.67	4.65	4.65	5.29	6.99
1170.00	889.62	5.32	4.50	5.90	3-M2t	10.00	3.02	5.25	5.25	5.65	7.43
1365.00	1041.90	5.90	5.00	6.54	3-M2t	10.00	3.35	5.83	5.83	5.96	7.81
1560.00	1195.08	6.45	5.51	7.16	3-M2t	10.00	3.67	6.38	6.38	6.24	8.15
1755.00	1347.17	6.99	6.00	7.75	3-M2t	10.00	3.98	6.91	6.91	6.49	8.46
1800.00	1378.44	7.12	6.09	7.88	3-M2t	10.00	4.04	7.03	7.03	6.53	8.53

Bridge Inventory & Appraisal (English)

(8) STRUCTURE NO	**000640917004864**	(1) STATE	**Kansas**	(4) CITY **Rural**		(3) COUNTY	**Morris**
(5A) ROUTE ON/UNDER	**Route On Structure**					HBP FUNDING ELIGIBILITY	**Not Eligible**

IDENTIFICATION

(5B) ROUTE TYPE	County Hwy
(5C) SERVICE TYPE	Mainline
(5D) ROUTE NUMBER 00000	(5E) SUFFIX N/A (NBI)
(6A) FEATURE INTERSECTED	LITTLE JOHN CREEK
(9) LOCATION	2.0E 1.5S COUNCIL GROVE
(16) LATITUDE	38 ° 38 ' 42.00 "
(17) LONGITUDE	96 ° 26 ' 00.00 "
(2) HIGHWAY AGENCY DISTRICT	Salina
(98A) BORDER BRIDGE STATE	Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY	%
(99) BORDER BRIDGE STRUCTURE NO.	_
(7) (ROUTE NAME) FACILITY CARRIED	LOCAL 112 U.4-500

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE	(13B) LRS SUBRTE #
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Not eligible for NRHP
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	30
(109) AVERAGE DAILY TRUCK TRAFFIC	-1 %
(30) YEAR OF ADT	2008
(27) YEAR BUILT	1975
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	6.200 MI

LOAD RATING

(66) INVENTORY LOAD RATING	23 ton, HS 12.00
(64) MAXIMUM LOAD RATING	27 ton, HS 14.00
(31) DESIGN LOAD	
(65) INVENTORY LOAD RATING METHOD	No rating
(63) OPERATING (MAX) LOAD RATING METHOD	No rating
(70) POSTING REQUIREMENTS	At/Above Legal Loads
(41) POSTING STATUS	Posted for Non-Load

SCHEDULE

(90) ROUTINEINSPECTION DATE			01/20/2010
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Not Applicable (P)
(75B) WORK BY	Unknown (NBI)
(76) IMPROVEMENT LENGTH	FT
(94) BRIDGE COST	
(95) ROADWAY COST	
(96) TOTAL COST	
(97) COST ESTIMATE YEAR	
(114) FUTURE ADT	35
(115) FUTURE ADT YEAR	2029

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	40.8 FT
(48) MAXIMUM SPAN LENGTH	39.0 FT
(32) ROUTE WIDTH	25.9 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	24.0 FT
(52) DECK WIDTH OUT TO OUT	24.3 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	23.6 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	99.99 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	0.0 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Tee Beam
(43A) MAIN SPAN MATERIAL TYPE	Prestressed Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	None
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	Unknown (P)
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	7
(59) SUPERSTRUCTURE CONDITION	7
(60) SUBSTRUCTURE CONDITION	6
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	5

APPRAISAL

DEFICIENCY STATUS	Not Deficient
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	6
(113) SCOUR VULNERABILITY	5
(67) STRUCTURAL EVALUATION	6
(68) DECK WIDTH APPRAISAL	6
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	84.00
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT


2011/ 7/15
NW mag
W:096°25' 03. 94"


2011/ 7/15
ESE mag
W:096°25' 34. 84"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 2

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	32.45	1159	V_{RA} (m/s) =	1.95	6.41
y_0 (m) =	1.3969	4.58	A_{culv} (m^2) =	16.62	178.86
w_{culv} (m) =	11.895	39	V_{CL} (m/s) =	2.35	7.71
D_{50} (m) =	0.0508	0.167	y_2 (m) =	1.16	3.81

y_{max} (m) =	2.63	Without wingwalls
y_{max} (m) =	2.04	With wingwalls
	Conversion (ft)	
y_{max} (ft) =	8.63	Without wingwalls
y_{max} (ft) =	6.70	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{UI} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	1159
y_0 (ft) =	4.58
w_{culv} (ft) =	39
w_a (ft) =	46
D_{50} (ft) =	0.167

Outputs	
V_{RM} (ft/s) =	8.86
A_{culv} (ft^2) =	178.62
V_{CN} (ft/s) =	8.15
y_2 (ft) =	4.98
q_1/q_2 =	0.85
x =	0.176

y_{max} (ft) =	7.55	Without wingwalls
y_{max} (ft) =	7.20	With wingwalls

Built = 1975

Bridge # = 000640917004864

Channel Bottom= Gravel, silt, sand, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
170.00	125.25	1.32	1.02	1.46	3-M2t	4.77	0.69	1.28	1.28	2.50	3.40
340.00	254.13	2.03	1.64	2.23	3-M2t	7.00	1.10	1.97	1.97	3.31	4.43
510.00	383.48	2.62	2.16	2.88	3-M2t	7.00	1.45	2.54	2.54	3.87	5.15
680.00	513.30	3.14	2.62	3.45	3-M2t	7.00	1.76	3.05	3.04	4.32	5.73
850.00	642.87	3.62	3.04	3.98	3-M2t	7.00	2.04	3.51	3.51	4.69	6.21
1020.00	773.78	4.07	3.44	4.48	3-M2t	7.00	2.31	3.95	3.95	5.03	6.63
1190.00	902.61	4.50	3.84	4.95	3-M2t	7.00	2.56	4.36	4.36	5.31	7.00
1360.00	1032.95	4.90	4.22	5.39	3-M2t	7.00	2.80	4.75	4.75	5.57	7.34
1530.00	1128.86	5.34	4.49	5.78	3-M2t	7.00	2.97	5.13	5.13	5.64	7.64
1638.00	1159.26	5.64	4.58	5.99	3-M2t	7.00	3.02	5.37	5.37	5.54	7.83

Bridge Inventory & Appraisal (English)

132

(8) STRUCTURE NO **000710687003880** (1) STATE **Kansas** (4) CITY **Rural** (3) COUNTY **Osborne**
(5A) ROUTE ON/UNDER **Route On Structure** HBP FUNDING ELIGIBILITY **Replacement**

IDENTIFICATION

(5B) ROUTE TYPE	County Hwy
(5C) SERVICE TYPE	Mainline
(5D) ROUTE NUMBER 00000	(5E) SUFFIX N/A (NBI)
(6A) FEATURE INTERSECTED	CENTER TWIN CREEK
(9) LOCATION	5.0S 6.0E OF OSBORNE
(16) LATITUDE	39 ° 21 ' 53.98 "
(17) LONGITUDE	98 ° 34 ' 59.45 "
(2) HIGHWAY AGENCY DISTRICT	Norton
(98A) BORDER BRIDGE STATE	Not Applicable (P)
(98B) BORDER BRIDGE RESPONSIBILITY	%
(99) BORDER BRIDGE STRUCTURE NO.	_
(7) (ROUTE NAME) FACILITY CARRIED	LOCAL RD OFF 132

FUNCTIONAL DESCRIPTION

(26) FUNCTIONAL CLASSIFICATION	Rural Local
(104) NHS DESIGNATION	Not on NHS
(100) STRAHNET DESIGNATION	Not a STRAHNET hwy
(110) NATIONAL TRUCK NET	Not part of natl netwo
(12) BASE HIGHWAY NET	Not on Base Network
(13A) LRS INVENTORY ROUTE 0000000000	(13B) LRS SUBRTE # 00
(11) LRS MILE POINT	0.000 MI
(105) FEDERAL LANDS HIGHWAY	N/A (NBI)
(20) TOLL	Rdwy Agrmt
(21) MAINTAINENANCE RESPONSIBILITY	County Hwy Agency
(22) OWNER	County Hwy Agency
(37) HISTORICAL SIGNIFICANCE	Possibly eligible for
(101) PARALLEL STRUCTURE	No || bridge exists
(103) TEMPORARY STRUCTURE	Unknown (NBI)

AGE AND SERVICE

(29) AVERAGE DAILY TRAFFIC	15
(109) AVERAGE DAILY TRUCK TRAFFIC	0 %
(30) YEAR OF ADT	2008
(27) YEAR BUILT	1920
(106) YEAR REHABILITATED	
(102) ONE WAY OR TWO WAY TRAFFIC	2-way traffic
(42A) SERVICE ON THE BRIDGE	Highway
(42B) SERVICE UNDER THE BRIDGE	Waterway
(28A) LANES ON ROUTE	2
(28B) LANES UNDER ROUTE	0
(19) BYPASS DETOUR LENGTH	8.700 MI

LOAD RATING

(66) INVENTORY LOAD RATING	8 ton, HS 3.00
(64) MAXIMUM LOAD RATING	14 ton, HS 7.00
(31) DESIGN LOAD	2 M 13.5 (H 15)
(65) INVENTORY LOAD RATING METHOD	AS Allowable Stress
(63) OPERATING (MAX) LOAD RATING METHOD	AS Allowable Stress
(70) POSTING REQUIREMENTS	30.0-39.9%below
(41) POSTING STATUS	Posting Recommended

SCHEDULE

(90) ROUTINEINSPECTION DATE			06/24/2011
(91) ROUTINE INSPECTION FREQUENCY			24 MO
(92) CRITICAL FEATURE INSPECTION:			(93) INSP DATE
A) FRACTURE CRITICAL	N	MO	A)
B) UNDERWATER INSP	N	MO	B)
C) SPECIAL INSP	N	MO	C)

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK	Rehabilitate-gen.
(75B) WORK BY	Contract
(76) IMPROVEMENT LENGTH	36.10 FT
(94) BRIDGE COST	$31000
(95) ROADWAY COST	$3000
(96) TOTAL COST	$46000
(97) COST ESTIMATE YEAR	2000
(114) FUTURE ADT	20
(115) FUTURE ADT YEAR	2031

GEOMETRIC DATA

(112) NBIS BRIDGE DEFINITION	Long Enough
(49) STRUCTURE LENGTH	22.0 FT
(48) MAXIMUM SPAN LENGTH	20.0 FT
(32) ROUTE WIDTH	22.0 FT
(51) BRIDGE ROADWAY WIDTH, CURB TO CURB	18.0 FT
(52) DECK WIDTH OUT TO OUT	20.0 FT
(50A) LEFT CURB OR SIDEWAY WIDTH	0.0 FT
(50B) RIGHT CURB OR SIDEWAY WIDTH	0.0 FT
(34) SKEW	0.0 °
(47) ROUTE HORIZONTAL CLEARANCE	18.0 FT
(10) MIN VERT CLEARANCE OVER ROUTE	99.99 FT
(53) MIN VERT CLEARANCE OVER BRIDGE	100.00 FT
(33) MEDIAN	No Median
(35) STRUCTURE FLARED	No flare
(54A) MIN VERT UNDERCLEARANCE REF	Feature not hwy or RR
(54B) MIN VERT UNDERCLEARANCE	0.00 FT
(55A) MIN LATERAL UNDERCLEAR REF RT	Feature not hwy or RR
(55B) MIN LATERAL UNDERCLEAR RT	100.1 FT
(56) MIN LATERAL UNDERCLEARANCE LEFT	0.0 FT

STRUCTURE AND MATERIALS

(45) NUMBER OF MAIN SPANS	1
(43B) MAIN SPAN DESIGN TYPE	Slab
(43A) MAIN SPAN MATERIAL TYPE	Concrete
(107) DECK TYPE	Concrete-Cast-in-Place
(108A) DECK SURFACE	Gravel
(108B) MEMBRANE	None
(108C) DECK PROTECTION	None
(46) NUMBER OF APPROACH SPANS	0
(44B) APPROACH SPAN DESIGN TYPE	-1
(44A) APPROACH SPAN MATERIAL TYPE	Unknown (NBI)

CONDITION

(58) DECK CONDITION RATING	5
(59) SUPERSTRUCTURE CONDITION	5
(60) SUBSTRUCTURE CONDITION	5
(62) CULVERT CONDITION	N
(61) STREAM STABILITY / CHANNEL	6

APPRAISAL

DEFICIENCY STATUS	Functionally Obsolete
(72) BRIDGE ROUTE ALIGNMENT	8
(71) WATERWAY ADEQUACY	5
(113) SCOUR VULNERABILITY	8
(67) STRUCTURAL EVALUATION	3
(68) DECK WIDTH APPRAISAL	4
(69) HORIZ. UNDERCLEARANCE APPRAISAL	N
SUFFICIENCY RATING	36.00
(36A) BRIDGE RAILS	0
(36B) RAIL TRANSITIONS	0
(36C) APPROACH GUARDRAILS	0
(36D) APPROACH GUARDRAIL ENDS	0

NAVIGATION DATA

(38) NAVIGABLE WATERWAY	Permit Not Required
(39) NAVIGATION VERTICAL CLEARANCE	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	FT
(111) SUBSTRUCTURE NAV PROTECTION	Unknown (NBI)
(116) MIN NAV VERT CLEAR VERT LIFT BRIDGE	FT

KANSAS BRIDGE INFORMATION

Bridge Name:	132
Bridge No.	710687003880
(201) Area Waterway Opening (Sq. Ft)	120
(202) Drainage Area (Sq. Mi.)	7.4
(203) Kansas Critical Feature	N
(204) Kansas Number of Girders (per span)	NA
(205) Kansas Load Rating (Tons)	11 13 19 20 25
(206) Kansas Posted Weight (Tons)	06 06 06
(207) Pier Foundation	0
(208) Kansas Highway System	11


UTC 2011:07:12 18:18:45
150' SSE trv
W:098° 34' 59.646"

METHOD 1

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

y_2 is equillibrium flow depth

D_{50} sediment size (in) 1

Inputs		Conversion (ft)	Outputs		Conversion (ft)
Q (m^3/s) =	7.08	253	V_{RA} (m/s) =	1.47	4.82
y_0 (m) =	0.78995	2.59	A_{culv} (m^2) =	4.82	51.87
w_{culv} (m) =	6.1	20	V_{CL} (m/s) =	1.71	5.60
D_{50} (m) =	0.0254	0.083	y_2 (m) =	0.68	2.23

y_{max} (m) =	1.54	Without wingwalls
y_{max} (m) =	1.20	With wingwalls
Conversion (ft)		
y_{max} (ft) =	5.06	Without wingwalls
y_{max} (ft) =	3.93	With wingwalls

METHOD 2

Q is volumetric flow through the culvert

y_0 is depth of flow in the approach to the culvert before scour

w_{culv} is width of the culvert inlet

q_1 is unit discharge in the approach section

q_2 is unit discharge in the contracted section

V_R is the representative local velocity at the entrance of culvert

V_C is the critical velocity at which incipient sediment motion occurs

w_{culv} is width of the bottomless culvert inlet

w_a is width of the approach section to the culvert

y_2 is equillibrium flow depth

D_{50} is sediment size

K_{U1} is 1.0 for U.S. customary units

K_{U2} is 1.0 for U.S. customary units

Inputs	
Q (ft^3/s) =	253
y_0 (ft) =	2.59
w_{culv} (ft) =	20
w_a (ft) =	30
D_{50} (ft) =	0.083

Outputs	
V_{RM} (ft/s) =	6.26
A_{culv} (ft^2) =	51.8
V_{CN} (ft/s) =	5.91
y_2 (ft) =	2.74
q_1/q_2 =	0.67
x =	0.202

y_{max} (ft) =	4.16	Without wingwalls
y_{max} (ft) =	3.97	With wingwalls

Built = 1920

Bridge # = 000710687003880

Channel Bottom= Gravel, sand, silt, and clay

Measured Scour (ft) = 2

HY-8 Analysis Results

Culvert Summary Table - Culvert 1

Culvert Crossing: Crossing 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	0.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
50.00	40.95	0.94	0.76	1.08	3-M2t	3.57	0.51	0.93	0.93	2.20	2.69
100.00	74.33	1.45	1.13	1.61	3-M2t	4.00	0.76	1.43	1.43	2.59	3.49
150.00	112.80	1.88	1.49	2.08	3-M2t	4.00	1.00	1.85	1.85	3.04	4.05
200.00	151.71	2.26	1.81	2.50	3-M2t	4.00	1.22	2.23	2.23	3.40	4.48
250.00	190.64	2.61	2.12	2.89	3-M2t	4.00	1.42	2.58	2.58	3.69	4.85
300.00	214.84	2.96	2.31	3.21	3-M2t	4.00	1.53	2.91	2.91	3.69	5.16
350.00	225.25	3.33	2.38	3.49	3-M2t	4.00	1.58	3.22	3.22	3.50	5.43
400.00	235.45	3.69	2.46	3.76	3-M2t	4.00	1.63	3.52	3.52	3.34	5.68
450.00	246.37	4.04	2.54	4.03	3-M2t	4.00	1.68	3.81	3.81	3.23	5.90
480.00	253.72	4.26	2.59	4.21	7-M2t	4.00	1.71	3.98	3.98	3.19	6.03

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VITA

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