Preliminary Engineering Study

for

Bridge Replacement
Salem Road over Tucker Creek
Conway, AR

FA Project No. CONWAYAR.0001ST

Prepared for:

February 2019

FISHER ARNOLD
ENGINEERING INTEGRATION

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APPENDICES

1.0 EXECUTIVE SUMMARY

Fisher Arnold (FA) has completed this Preliminary Engineering Study to support the City of Conway, Arkansas with a grant application for the FHWA Accelerated Innovation Deployment (AID) Grant Program. This grant program provides a maximum award up to $1M per project at an 80/20 federal/local percent cost share. The program exists as a mechanism to deploy transportation technology developed through the FHWA Every-Day-Counts (EDC) Initiatives. Projects submitted for the AID Grant program must be supported by the State DOT, so ARDOT would be involved in review of the project application and would need to support the project's submittal to the FHWA. Projects accepted for AID funding must utilize EDC innovations. The AID funding applies to the portion(s) of a project's cost which incorporates the innovation, rather than the total project cost. EDC Innovations developed through the Preliminary Engineering Study and applicable to this bridge replacement include:

- Accelerated Bridge Construction (ABC)
- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)
- Prefabricated Bridge Elements and Systems (PBES)
- Safe Transportation for Every Pedestrian (STEP)

Preliminary Engineering work completed thus far has allowed for the development of an "Engineer's Opinion of Probable Cost to Construct". The cost, totaling $2,123,470 for replacement of Salem Road over Tucker Creek, does not include right-of-way acquisition or any utility relocations needed. The recommended replacement bridge structure would be a single, 75-foot span superstructure supported by GRS-IBS abutments. The bridge would carry four traffic lanes, with 8 foot pedestrian sidewalks on each side. The proposed superstructure is a side-by-side prestressed concrete box beam bridge, which qualifies as both PBES and ABS technologies. As an alternate to the prestressed concrete box beam superstructure, consideration could be made for prefabricated and pre-topped deck steel beams, also meeting the qualifications for PBES and ABS, but likely more costly. Final bridge replacement designs, including traffic control and phasing, must accommodate the following functions:

1. Relocation of utilities and existing drainage structures
2. Abbreviated road closure window of up to 90 days to allow contractor access for replacement bridge construction
3. Demolition of the existing four-barrel box bridge structure
4. Construction of the new GRS-IBS bridge abutments
5. Re-alignment of the Tucker Creek Walking/Bike Trail to pass underneath proposed bridge structure; including removal of signalized pedestrian crosswalk; and creekside retaining wall along trail.
6. Installation of the new superstructure
7. Paving and roadway approach improvements

1.1 Limitations, Assumptions, & Exceptions

The observations and recommendations shown herein are based on the specific work efforts completed to date including cursory field observations and review of provided information. Hydraulic and Hydrologic modeling, geotechnical investigations, roadway design, and bridge structural and foundation design have not been performed, and could result in findings which may cause the final design and associated construction cost to vary.

1.2 Reference Documents

The appendices contain technical details, photographs, and existing and proposed configurations which may be helpful to the user for interpretation of the recommendations contained in this report.

1.3 User Reliance

To fulfill the request of our client, FA has developed the technical content contained in this report. This work product has been prepared under contract for exclusive use by the City of Conway and the Arkansas Department of Transportation (ARDOT). Reliance by any other party is expressly prohibited and at their own risk unless written authorization for use is granted by FA.

2.0 EXISTING CONDITIONS SALEM ROAD OVER TUCKER CREEK

The existing bridge carrying Salem Road over Tucker creek is a 2-lane, 4 span structure constructed with a steel pan supported concrete deck cast atop masonry block walls. The masonry abutment and intermediate walls are supported on a cast-in-place concrete slab (**Photos 1 & 2**). There are no sidewalks on the existing bridge. Railings are constructed from steel pipe and are attached to the superstructure at the masonry piers. Plans for the existing structure and/or bridge inspection reports were not provided to FA for preparation of this study. Reinforcement and structural details for the masonry abutments, piers, foundation, and wingwalls is unknown.

Photo 1
Downstream Side of Existing Bridge

Photo 2
Upstream Side of Existing Bridge

2.1 Geometry and Configuration

At the subject bridge site, Tucker Creek flows from the northeast toward the southwest. The existing 4-span structure, although different in construction, is similar to a 4-barrel box culvert with a concrete floor slab which interrupts the natural stream bed upstream and downstream of the existing bridge (**Photo 3 & 4**). On the downstream side of the structure, the streambed is approximately 12-18" below the elevation of the concrete floor slab. The 4-barrel structure is oriented generally parallel with the flowline of Tucker Creek, thus forming an approximate 60 degree skew angle with Salem Road.

Photo 3
Tucker Creek Looking Downstream

Photo 4
Tucker Creek Looking Upstream

2.2 Observations

The Tucker Creek Walking/Bike Tail generally parallels the north bank of Tucker Creek in the area of the bridge site. Approximately 25 feet north of the existing bridge structure, the trail crosses Salem Road, at-grade, at a signalized pedestrian crosswalk (**Photo 5**). Trail pedestrians, both walkers and bikers, must currently cross Salem Road at grade. In contrast, at the nearest downstream intersection of the Tucker Creek Trail and S. Country Club Rd., the trail passes underneath S. Country Club Rd., thus eliminating traffic delays and safety hazards of an at-grade crossing. Additionally, pedestrians traveling along Salem Road do not have access to continuous sidewalks, as the two-lane bridge structure does not provide for such.

Drainage structures are located near the wingwalls at all four corners of the bridge. Storm drains empty into Tucker Creek thru concrete pipe (NE, NW, & SW) or concrete drainage flume (SE) (**Photos 6-10**). The concrete flume presents a particular challenge for pedestrians traveling north on Salem Road, as they must leave the sidewalk and walk along the roadway shoulder to keep from accidentally stepping down into the flume (**Photo 10**).

Photo 5
Trail Crossing Salem Road

Photo 6
NW Storm Drain Thru Wingwall

Photo 7
NE Storm Drain Thru Wingwall

Photo 8
SW Storm Drain Outside Wingwall

Photo 9
SE Storm Drain Flume Looking South

Photo 10
SE Storm Drain Flume Looking North

3.0 PROPOSED BRIDGE REPLACEMENT OF SALEM ROAD OVER TUCKER CREEK

To assist in our preliminary engineering evaluation of bridge reconstruction options, the City of Conway furnished FA with the desired roadway cross section (4 traffic lanes, 8 foot sidewalks each direction, and 9 foot clearance from the trail to underside of replacement bridge structure. Additionally, the McKinley Trail System drawings, the 2006 FEMA Flood Insurance study, and a copy of utility locations from Conway Corporation were provided to FA.

The proposed replacement bridge will use some or all of the following AID grant qualifying EDC Innovations:

- **Accelerated Bridge Construction (ABC)**
  Accelerated bridge construction technologies have broadened the options available for constructing and/or replacing bridge structures. These technologies allow for reduced construction timelines and associated reductions in user costs. The following technologies that are proposed for use on this project were developed through the FHWA's Every Day Counts 2 (EDC-2) initiatives. Additional information on that program can be found by visiting:
  https://www.fhwa.dot.gov/innovation/everydaycounts/edc-2.cfm

  1. **Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)**
     GRS-IBS bridge systems allow for completion of lower cost single-span bridge structures in less construction time than conventional bridge structures. Similar to a mechanically stabilized earth structure, a GRS-IBS abutment (**Photos 11 & 12** courtesy of FHWA) consists of layers of compacted select fill with geotextile fabric with a masonry or concrete facing. The abutment is capable of supporting the reactions of "integrally" embedded beams or girders.

Photo 11
Typical GRS-IBS Abut.

Photo 12
Typical GRS-IBS Abutment

2. Prefabricated Bridge Elements and Systems (PBES)

Completion of the superstructure can be accelerated by using PBES. In **Photo 13** (courtesy of FHWA), side-by-side prestressed concrete box beams are supported on the GRS-IBS abutment. Beams are designed to carry the required live a dead loads without the need for cast-in-place concrete deck, thus reducing construction time. PBES are fabricated offsite, usually under safe, plant quality controlled conditions, while site work is simultaneously occurring. As an alternative to the recommended option for use of precast, prestressed concrete box beams, the City of Conway could consider using a single-span pre-fabricated steel bridge system (**Photo 14** courtesy of the Short Span Steel Bridge Alliance).

Photo 13 - Prestressed Beams on GRS-IBS Abutment

Photo 14 - Prefabricated Steel Bridge System

- **Safe Transportation for Every Pedestrian (STEP)**
  Pedestrian safety is an important part of every project and was a focus area for FHWA's Every Day Counts 4 (EDC-4) initiatives. Pedestrian safety countermeasures include Road Diets and Crosswalk Visibility Enhancements. Road Diets include vehicle speed and lanes-to-cross reductions. Creating new space for pedestrians is also a part of the Road Diet strategy. The proposed bridge structure will have 8 foot sidewalks on each side of Salem Rd. We believe that adding pedestrian sidewalks, eliminating the existing pedestrian crosswalk and placing the trail underneath the proposed bridge structure qualify as STEP initiatives.

  Additional information on the STEP program can be found by visiting:
  https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm

3.1 Proposed Bridge Configuration

The proposed bridge will be a single span structure oriented on the center line of Salem Rd. The clear span for the 48" wide x 36" deep prestressed concrete box beam bridge beams will be approximately 75 feet. The bridge would carry four traffic lanes, with 8 foot pedestrian sidewalks on each side. The proposed bridge structure will have an overall width of approximately 68 feet and length of 83 feet; thus totaling approximately 5810 square feet.

GRS-IBS abutments will be constructed behind the existing abutment walls. The proposed northern abutment will need to be moved approximately 25 feet north of the existing bridge to accommodate relocation of the trail underneath the proposed bridge. Based on information gathered during our field site visit, it is likely that the existing bridge is supported on shallow foundations bearing on or anchored to visually observable rock in the streambed. The proposed GRS-IBS abutments can bear on sound rock, thus eliminating any need for extensive or deep foundations. GRS-IBS abutment walls will be approximately 10-16 feet in height, and will need to be designed based on hydraulic and geotechnical investigations which are yet to be performed. Walls of this height will allow for the required walking trail vertical clearance, however providing this clearance will require that the roadway and bridge profile grade line be raised 2-3 feet. The proposed bridge would likely be constructed in a crest vertical curve to allow for raising the grades at the bridge location. Plans and sections for the proposed bridge structure are attached as **Appendix A**.

3.2 Demolition & Construction Sequence Timeline

We recommend that the replacement bridge be constructed under an abbreviated road closure of up to 90 days. Upon closure of both Salem Road and the Tucker Creek Walking/Biking Trail, demolition of the existing structure could begin. Based on FHWA demonstration program guidance, FA believes that demolition of the existing structure and construction of the GRS-IBS abutments could be completed within the first 30 days of the project schedule. During this time, and even prior to demolition, fabrication of the precast, prestressed concrete box beams could be completed offsite.

Erection of the superstructure could be completed and temporarily opened to traffic within two weeks. Completion of parapets, guardrails and other ancillary bridge items could be completed while under traffic (2-lanes only) and behind portable barrier rail. Roadbed, final paving, trail relocation and paving can all occur during the final 30-45 days of the proposed schedule.

3.3 Utilities & Drainage

Prior to bridge reconstruction, there are a number of affected utilities which would need to be addressed. The proposed construction timeline allows for completion of all utility relocation before beginning the bridge reconstruction timeline. **Appendix B** shows a map of utilities provided by Conway Corporation along with an overlay of the proposed bridge structure. From this map it can be seen that primary overhead electric, water, and sewer lines will likely need to be relocated. Additionally there are underground telecommunication line(s) which may be affected. The presence of underground natural gas lines in the project area is undetermined.

Stormwater drainage will need to be addressed in all four quadrants of the proposed bridge structure. Of particular attention is the existing drainage "flume" in the southeast quadrant and parallel to Salem Rd. Re-routing of this drainage to extend under Salem Road, continuing westward to tie into the downstream side of the proposed Tucker Creek Bridge, should be considered. On the north side of the proposed bridge, stormwater infrastructure should be designed to avoid conflict with the proposed walking trail relocation.

3.4 Environmental Impacts

This bridge replacement project is situated along Tucker Creek, a jurisdictional stream which empties into Tupelo Bayou, and eventually into the Arkansas River. Additionally, the project is near residential and light commercial areas and within the Tucker Creek Walking/Biking Trail. The City of Conway should expect this project to require (at a minimum) coordination with the following agencies:

- Arkansas Department of Transportation (ARDOT)
- US Army Corps of Engineers
- Federal Highway Administration – Little Rock Division Office
- Arkansas Department of Environmental Quality (ADEQ)
- The Department of Arkansas Heritage (State Historic Preservation Office)

Permitting provisions through these coordinating agencies will include following the applicable provisions of the National Environmental Policy Act (NEPA). It is possible that this project would qualify for a categorical exclusion under NEPA. Provision of Section 404 of the Clean Water Act and a Section 401 Aquatic Resources Alteration Permit would also need to be addressed as a part of this project. Noise, air and stormwater permitting for the construction process would also be considered. The proposed construction techniques will help to mitigate some of these issues.

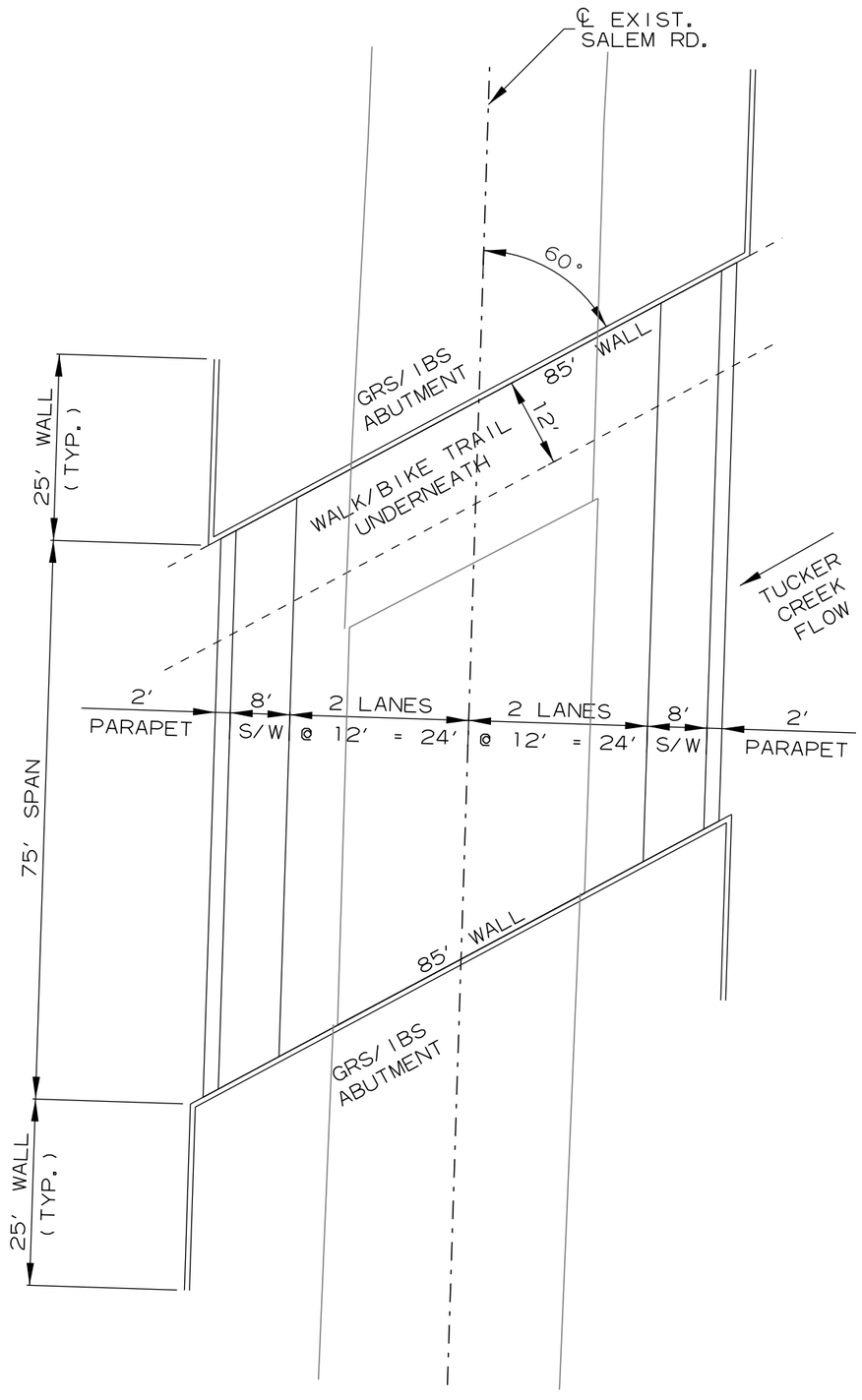
3.5 Engineer's Opinion of Probable Cost to Construct

Appendix C contains a breakdown of the anticipated construction items. The total for each of the items has been portioned according the to 80/20 Federal/Local match. Right-of-way acquisition and utility relocation costs are NOT included in these totals. Mobilization, contingencies, and engineering and construction administration costs have been accounted for as a percentage of construction items as shown in the spreadsheet. We believe that the AID innovations incorporated into this cost evaluation exceed $1,000,000 and therefore justifies a request for the maximum funding allowed through the Accelerated Innovation Deployment (AID) Demonstration Grant Program under the multi-faceted Technology and Innovation Deployment Program (TDIP) of the Federal Highway Administration. The total Engineer's Opinion of Probable Cost to Construct, excluding ROW acquisition and utility relocation, is $2,123,470.

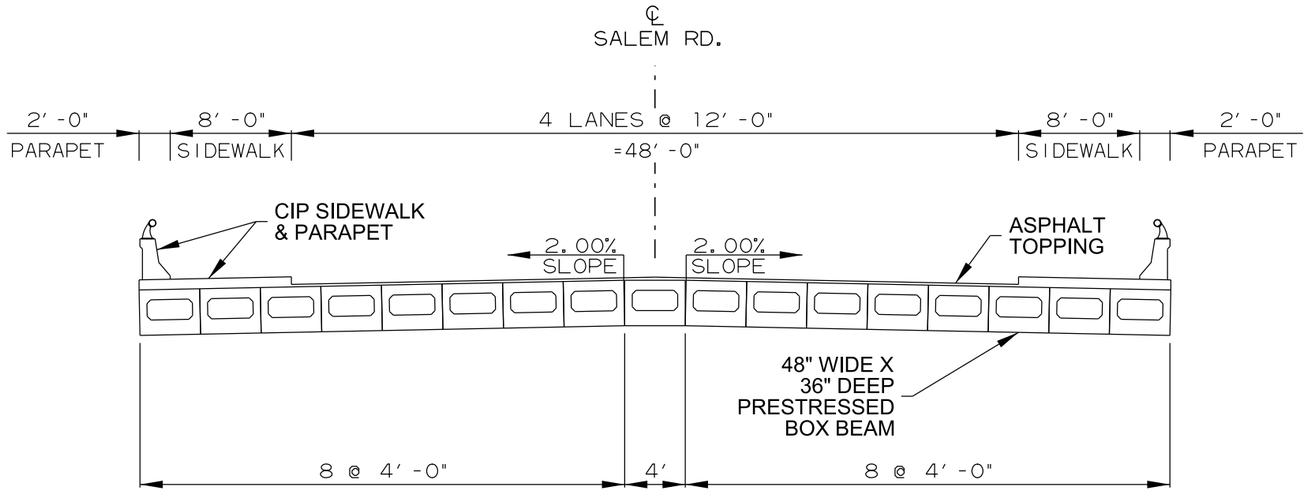
Appendix A

Proposed Bridge Plan and Sections

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.				
				(2)	BRIDGE LAYOUT			



PROPOSED PLAN VIEW



PROPOSED SECTION

BRIDGE LAYOUT
TUCKER CREEK

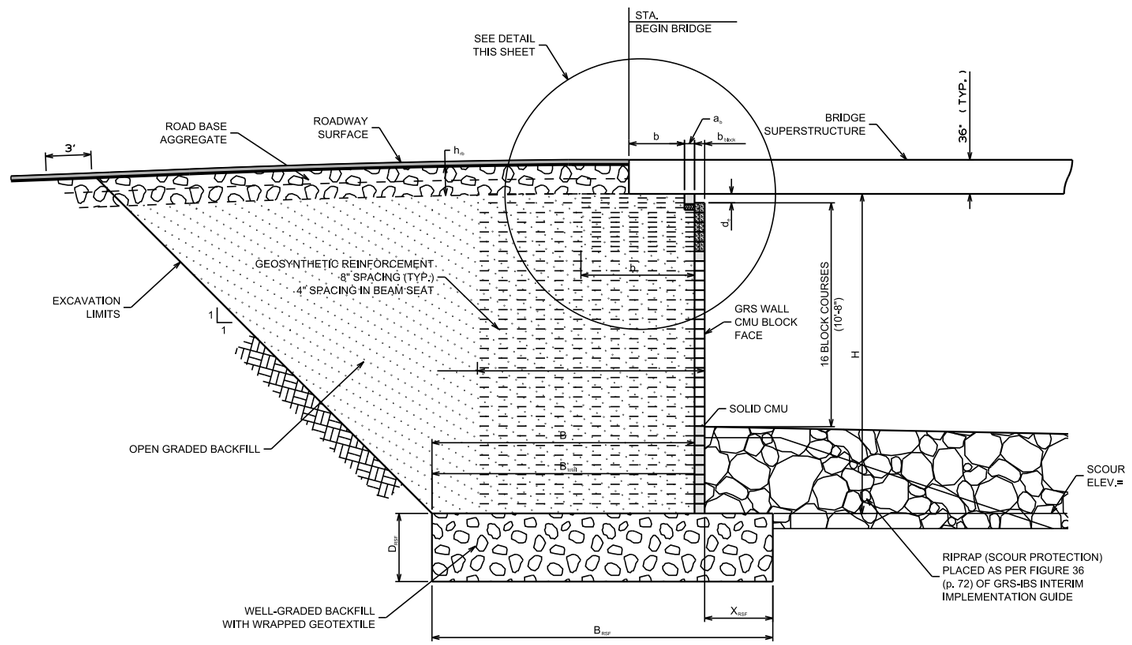
SALEM ROAD
CITY OF CONWAY
ARKANSAS

DRAWN BY: TJH DATE: FILE NAME:
CHECKED BY: AM DATE: SCALE: 1"=20'
DESIGNED BY: AM DATE:

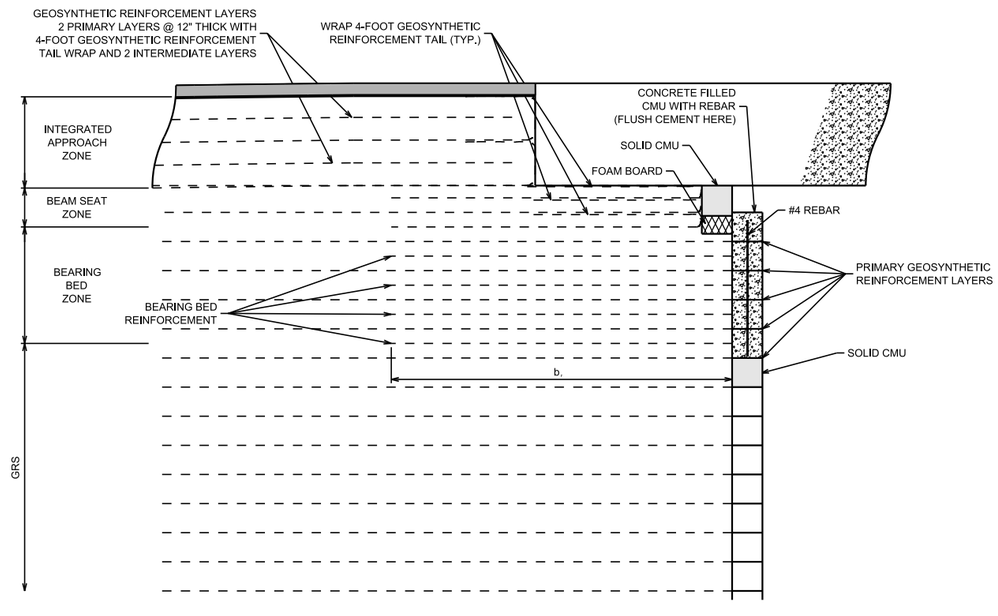
BRIDGE NO. DRAWING NO.

1/28/2019
Z:\CONWAYAR\000IST\Transportation\CONWAYAR.000IST-BridgeLayout.sht

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.				
				2	GRS-IBS DETAILS - ABUTMENT			



SECTION ALONG ROADWAY CENTERLINE
AT ABUTMENT
SCALE: 1"=5'



DETAIL
(BEAM SEAT AND INTEGRATED APPROACH DETAIL)
SCALE: N.T.S.

NOTE:

1. Insert #4 rebars in to the top 5 rows of CMU's below beams, the top 9 rows of CMU's outside of beams and corner CMU's and fill same with concrete.
2. Strike CMU concrete fill flush with top of CMU's under bridge girders slope to drain.
3. On the top row of CMU's create a mortar capping approx. ¾-inch thick (under beams).
4. See GRS-IBS Design Dimension Table on drawing no. 53285.

GRS-IBS DETAILS - ABUTMENT
TUCKER CREEK

SALEM ROAD
CITY OF CONWAY
ARKANSAS

DRAWN BY: TJH DATE: FILE NAME:
CHECKED BY: AM DATE: SCALE: 1"=5'
DESIGNED BY: AM DATE:

BRIDGE NO. DRAWING NO.

1/28/2019
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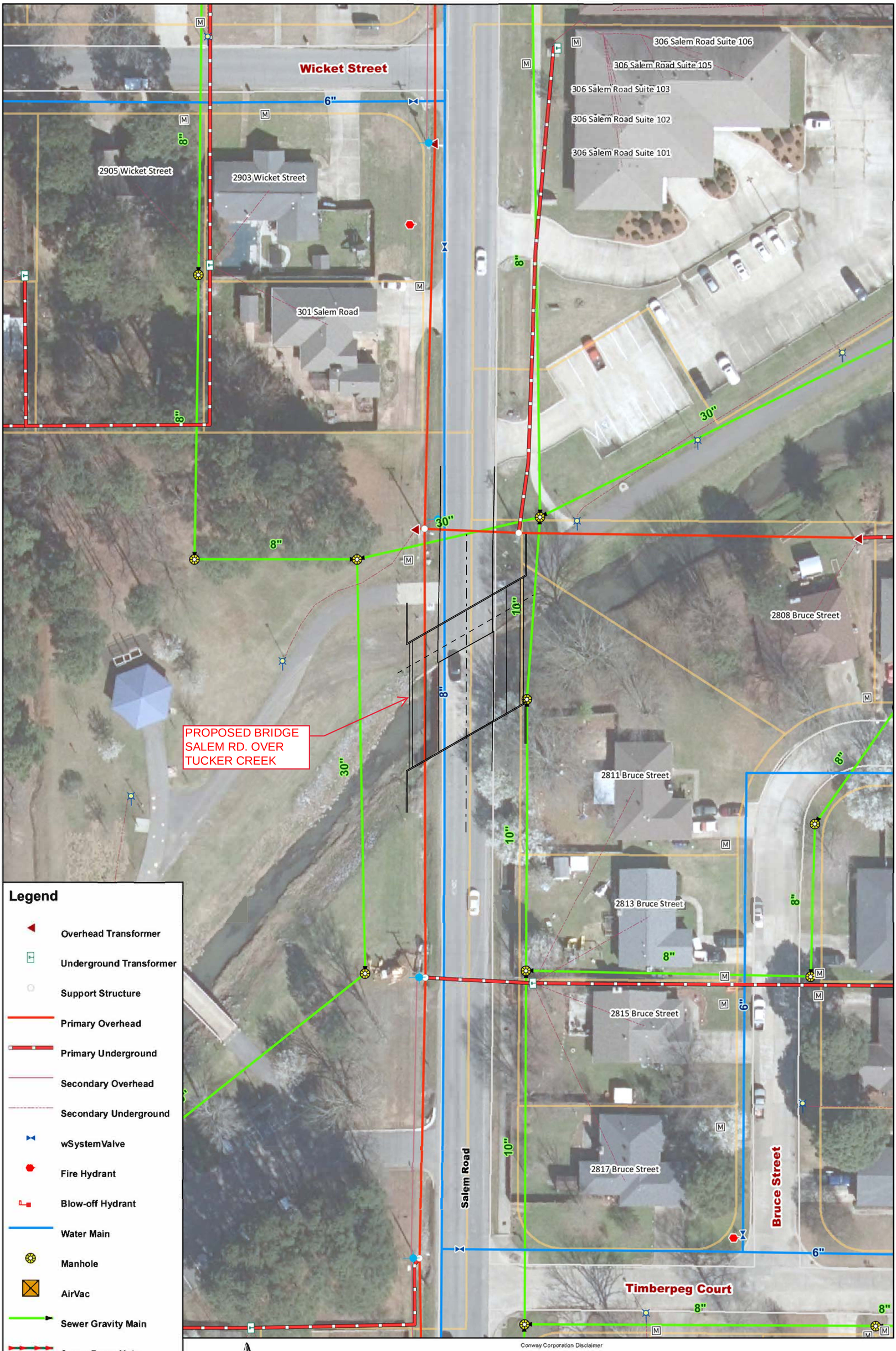
Appendix B

Proposed Bridge Location

Conway Corp. Utility Plan


Wicket Street
6"
8"
2905 Wicket Street
2903 Wicket Street
301 Salem Road
306 Salem Road Suite 106
306 Salem Road Suite 105
306 Salem Road Suite 103
306 Salem Road Suite 102
306 Salem Road Suite 101
30"
8"
10"
PROPOSED BRIDGE
SALEM RD. OVER
TUCKER CREEK
2808 Bruce Street
2811 Bruce Street
2813 Bruce Street
2815 Bruce Street
2817 Bruce Street
Salem Road
Bruce Street
Timberpeg Court
Legend
Overhead Transformer
Underground Transformer
Support Structure
Primary Overhead
Primary Underground
Secondary Overhead
Secondary Underground
wSystemValve
Fire Hydrant
Blow-off Hydrant
Water Main
Manhole
AirVac
Sewer Gravity Main
Sewer Force Main
City Boundary
1 inch = 50 feet
Conway Corporation
Utilities
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Appendix C

Engineer's Opinion of Probable Cost to Construct

FISHER ARNOLD
ENGINEERS | ARCHITECTS | CONSULTANTS | PLANNERS

Engineer's Opinion of Probable Cost To Construct *

Agency:	City of Conway, AR
Project:	Salem Road over Tucker Creek
Description:	Bridge Replacement
Location:	
State:	Arkansas
County:	Faulkner
Date:	2/5/2019

*** This evaluation is *not* based on any completed design work for this project, only preminimary assessments.**

DESCRIPTION	LOCAL 20%	STATE 0%	FEDERAL 80%	TOTAL
Construction Items				
Pavement Removal	$ 880.00	$ -	$ 3,520.00	$ 4,400.00
Asphalt Paving	$ 18,224.16	$ -	$ 72,896.64	$ 91,120.80
Concrete Paving	$ 4,740.00	$ -	$ 18,960.00	$ 23,700.00
Drainage	$ 14,846.00	$ -	$ 59,384.00	$ 74,230.00
Appurtenances	$ 5,409.33	$ -	$ 21,637.33	$ 27,046.67
Structures	$ 173,515.00	$ -	$ 694,060.00	$ 867,575.00
Fencing	$ 7,500.00	$ -	$ 30,000.00	$ 37,500.00
Earthwork	$ 25,920.00	$ -	$ 103,680.00	$ 129,600.00
Clearing & Grubbing	$ 900.00	$ -	$ 3,600.00	$ 4,500.00
Seeding & Sodding	$ 6,750.00	$ -	$ 27,000.00	$ 33,750.00
Rip-Rap or Slope Protection	$ 10,370.37	$ -	$ 41,481.48	$ 51,851.85
Guardrail	$ 4,806.00	$ -	$ 19,224.00	$ 24,030.00
Signing	$ 500.00	$ -	$ 2,000.00	$ 2,500.00
Pavement Markings	$ 132.58	$ -	$ 530.30	$ 662.88
Maintenance of Traffic	$ 2,000.00	$ -	$ 8,000.00	$ 10,000.00
	$ -	$ -	$ -	
	$ -	$ -	$ -	
Mobilization (8% construction cost)	$ -	$ -	$ -	$ 110,597.38
Other Items = 10%	$ -	$ -	$ -	$ 138,246.72
Construction Contingency = 10%	$ -	$ -	$ -	$ 138,246.72
Construction Items Subtotal	$ 276,493.44		$ 1,105,973.76	**$ 1,769,558.01**

Right-of-Way & Utilities				
ROW		$ -	$ -	$ -
Utilities		$ -	$ -	$ -

Engineering & Construction Administration		
Engineering Design	10.0%	$ 176,955.80
CEI	10.0%	$ 176,955.80
Engineering & Construction Administration Subtotal		**$ 353,911.60**

TOTAL PROJECT COST	**$ 2,123,469.62**