LETTING DATE
Jun. 16, 2026

Bridge Replacement - CCS
BRF-021-1(46)--38-54

KEOKUK COUNTY

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IOWA DOT

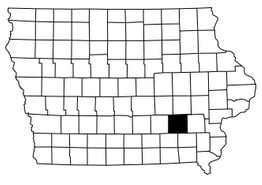
PLANS OF PROPOSED IMPROVEMENT ON THE

PRIMARY ROAD SYSTEM
KEOKUK COUNTY
Bridge Replacement - CCS

IA 21 over Cedar Creek
1.1 mi. N. of IA 92

Refer to the Plan Sheets for list of applicable specifications.

Value Engineering Saves. Refer to Article 1105.14 of the Specifications.



Standard Road Plans

Standard Road Plans are listed on sheet number C.10.

Design Data Rural

2024 AADT	1,930 V.P.D.
TRUCKS	18 %
Total Design ESALs	N.A.

Index of Seals

Sheet No.	Name	Type
A.1	Samantha L. Wermager	Structural Design
V.4	Mark D. Werner*	Hydraulic Design
SPS.1	Xinyi Jiang**	Geotechnical Design
CS.1	Buddika Godagama**	Soils Tabulations
A.3	Gregory S. Shuger*	Roadway Design

*Provided by Stanley Consultants
** Provided by Braun Intertec

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English Bridge Standards

Standard	Issued	Revised

Revisions

	TOTAL
	91
PROJECT IDENTIFICATION NUMBER	
21-54-021-020	
CONTRACT ID NUMBER	
54-0211-046	
PROJECT NUMBER	
BRF-021-1(46)--38-54	
R.O.W. PROJECT NUMBER	
PROJECT DIRECTORY NUMBER	
5402102021	

Iowa DOT Bridges and Structures
Consultant Coordinator Contact: Lili Yang

Structural Design

LICENSED PROFESSIONAL ENGINEER
Samantha L. Wermager
P26065
IOWA

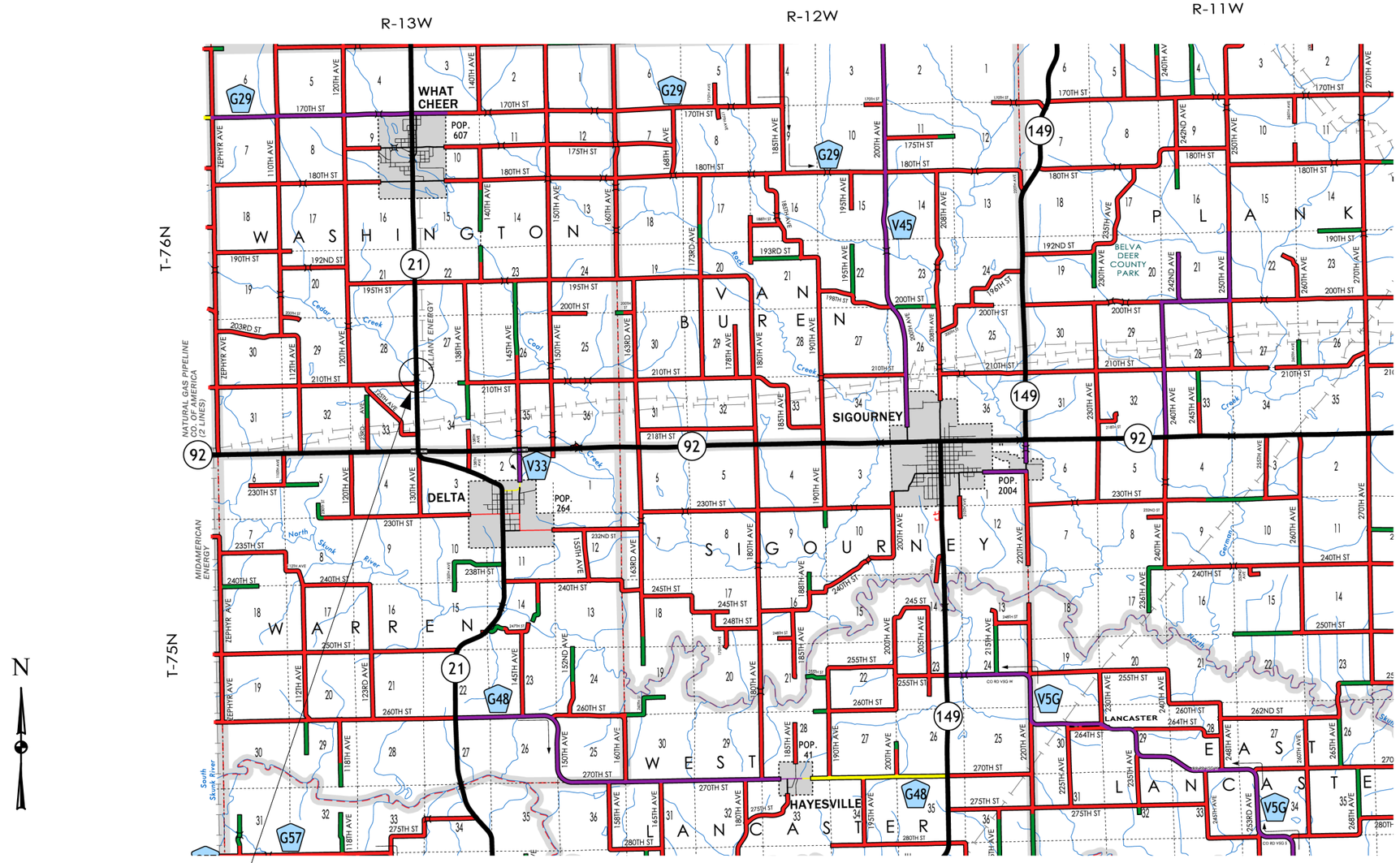
I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Samantha L. Wermager — 3-30-2026
Signature — Date

Samantha L. Wermager
Printed or Typed Name

My license renewal date is December 31, 2027

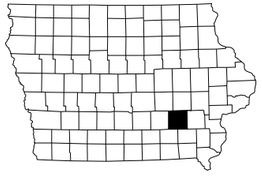
Pages or sheets covered by this seal: A.1-A.2, V.1-V.26



Design No. 0326
FHWA No. 032601

Keokuk County Location Map

Not To Scale



LEGEND

- INTERSTATE HIGHWAY
- PRIMARY HIGHWAY-DIVIDED
- PRIMARY HIGHWAY
- PORTLAND CEMENT CONCRETE ROAD
- ASPHALT ROAD
- BITUMINOUS ROAD
- GRAVEL ROAD
- EARTHEN ROAD

- INTERSTATE HIGHWAY
- UNITED STATES HIGHWAY
- STATE HIGHWAY
- COUNTY HIGHWAY

- RAILROAD
- PIPELINE
- AIRPORT
- HYDROLOGY
- BRIDGE

- STATE BOUNDARY
- COUNTY BOUNDARY
- CORPORATE BOUNDARY
- TOWNSHIP LINE
- SECTION LINE
- ROAD NAMES — ABBEY ROAD
- UNINCORPORATED PLACE — ELWOOD

- STATE PARKS
- STATE INSTITUTIONS
- FEDERAL LAND

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER A.2

4:39:47 PM 3/30/2026 jcrogers2 pw:\\projectwise.dot.int.lan:PWMain\Documents\Projects\5402102021\Bridge\(46)_CCS Bridge Replacement\SHT_54021046_0326_032601_Z13_BEGIN.dgn

Estimated Bridge Quantities - Design 0326

Item No.	Item Code	Item	Unit	Total	As Built Quantity
1	2104-2710020	Excavation, Class 10, Channel	C.Y.	1,006.0	
2	2401-6745625	Removal of Existing Bridge	L.S.	1.00	
3	2402-2720000	Excavation, Class 20	C.Y.	150	
4	2403-0100010	Structural Concrete (Bridge)	C.Y.	612.5	
5	2403-1000005	Fiber Reinforcement for Structural Concrete	C.Y.	447.4	
6	2403-1000010	Trial Batch and Test Placement (Fiber Reinforced Concrete)	L.S.	1.00	
7	2404-7775000	Reinforcing Steel	Lb.	36,843	
8	2404-7775005	Reinforcing Steel, Epoxy Coated	Lb.	126,486	
9	2404-7775009	Reinforcing Steel, Stainless Steel	Lb.	3,712	
10	2408-7800000	Structural Steel	Lb.	1,878	
11	2414-6424110	Concrete Barrier Railing	L.F.	307.0	
12	2433-0001060	Concrete Drilled Shaft, 60 in. Diameter	L.F.	209.0	
13	2433-0003000	Demonstration Shaft	L.F.	41.5	
14	2501-0201042	Piles, Steel, HP 10x42	L.F.	840	
15	2501-6335010	Prebored Holes	L.F.	160	
16	2507-3250005	Engineering Fabric	S.Y.	1,641.0	
17	2507-6800061	Revetment, Class E	Ton	1,491.0	
18	2507-8029000	Erosion Stone	Ton	38.0	
19	2520-0005010	Pop-Up Network Device	Each	1.00	
20	2520-3350010	Field Laboratory	Each	1.00	
21	2526-8285040	Construction Survey, Location Survey	L.S.	1.00	
22	2533-4980005	Mobilization	L.S.	1.00	
23	2599-9999010	Prefabricated Bridge Superstructure Move	L.S.	1.00	
24	2599-9999010	Prefabricated Bridge Superstructure Temporary Works	L.S.	1.00	

Item No.	Estimated Reference Information
1.	Includes excavation for revetment and berm lining near both abutments and piers. All waste must be removed from the project site.
2.	The lump sum bid for "Removal of Existing Bridge" shall include removal and disposal of the existing structure, including all attached guardrail. All salvageable material and unsalvageable material shall become the property of the contractor and shall be removed from the site by the contractor. The existing pier shall be removed to an elevation at least two feet below finished groundline and to the extent it will not interfere with the new construction, nor the temporary works for the 'Prefabricated Bridge Superstructure Move'. Contractor to add the following information when submitting the Iowa DNR "Notification of Demolition" form: Name of Asbestos Inspector: Brad Azeltine Date Inspected: 6/2/2022 IA License Number: Iowa DOT Phone: 515-239-1938 Procedure used to detect the presence of asbestos materials: Polarized Light Microscopy (PLM)
3.	Includes excavation for bridge abutments and wings. Additional excavation associated with construction of temporary works will be subsidiary to the bid item "Prefabricated Bridge Superstructure Temporary Works".
4.	Concrete for the slab, abutment diaphragms, abutment footings, pier diaphragms, and pier caps shall be Class C, with a 28-day strength of 4.0 ksi, as defined in Section 2403 of the Standard Specifications. Includes permanent neoprene bearing pads at abutments and piers. Includes all resilient joint filler and non-shrink grout required. Includes furnishing and placing subdrain (including excavation), floodable backfill, porous backfill, geotextile fabric, water flooding, butyl rubber membrane, and subdrain outlet at abutments. Includes furnishing and placing 3 inch diameter PVC plastic pipe and expanding foam in the abutment wings. Includes furnishing and placing concrete sealer on the pier cap as shown in these plans.
5.	Includes the cost of fiber reinforcement for the slab, abutment diaphragms, and pier diaphragms. The concrete is to be paid for in the bid item "Structural Concrete (Bridge)". Refer to Developmental Specifications for "Fiber Reinforcement for Structural Concrete" for additional information.
6.	All work and materials shall be in accordance with Section 2403 of the Standard Specifications unless noted otherwise. The method of measurement for payment shall be lump sum and shall include all labor and materials necessary for trial batch and test placement of fiber reinforced concrete. The Contractor will be paid the contract unit price for Trial Batch and Test Placement (Fiber Reinforced Concrete) upon acceptance of the trial batch and placement by the Iowa DOT's Resident Construction Engineer. Refer to the Developmental Specification for "Fiber Reinforcement for Structural Concrete" for additional information.
8.	Includes mechanical splicers in the abutment footing and superstructure.
10.	Includes cost of 4 drains at 45 lbs. steel per drain. Includes 1,336 lbs. of stainless steel embedded plates (for slide option), and 362 lbs. of corrugated metal pipe.
11.	If placement of concrete is done by the slipforming method, Class BR concrete is required. Cast-in-place barrier rails shall use Class C mix. Price bid for this item shall include the cost of cast-in-place forms if required, for placement of the concrete.
12.	Includes cost of C.S.L. testing at each shaft. Submittal of a drilled shaft installation plan shall be required. Length measured from bottom of rock socket to construction joint. See Design Sheet 10 for additional notes.
13.	Demonstration shaft shall be as detailed on Design Sheet 10. Includes all costs of materials and labor including concrete, reinforcing steel, excavation and excavation incidentals including casing and C.S.L. testing of shaft. See Design Sheet 10 for additional notes.
16.	Engineering fabric shall be material as specified for embankment erosion control in accordance with Article 4196.01,B,3, of the Standard Specifications. Material shall be measured in sq. yard of actual area covered.
17.	Estimated at 1.5 ton/cu yd. Class E revetment shall meet requirements of Section 4130 of the Standard Specifications.
18.	Estimated at 1.6 ton/cu. yd. Erosion Stone shall meet the requirements of Section 4130 of the Standard Specifications.
23.	Refer to Special Provisions for Prefabricated Bridge Superstructure Move. Includes cost of temporary laminated neoprene bearings with PTFE as shown on these plans. If additional bearing pads are needed for the Contractor's means and methods of Prefabricated Superstructure Move, they shall be incidental and no additional payment will be made. Bearings used for superstructure move shall not be used for final construction.
24.	Refer to Special Provisions for Prefabricated Bridge Superstructure Move.

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Staking Diagram	V.7
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Abutment Backfill Details	V.26

Traffic Control Plan

The roadway will be closed to thru traffic only during the critical closure period. Refer to the traffic control plan shown elsewhere in these plans.

Note:
404 permit information and the Pollution Prevention Plan are shown elsewhere in these plans.

Note:
Roadway quantities are shown elsewhere in these plans.

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans — 55'-0" Interior Span

Estimated Quantities

STA. 57+50.00 (℄ IA 21) — Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 — Design Sheet No. 1 of 26 — FHWA No. 032601

Summary of Concrete Quantities

Location		Structural Concrete
South Abutment Footing		20.9
North Abutment Footing		20.9
Abutment Wings	4 @ 1.613	6.5
Superstructure ‡		447.4 (F)
Pier No. 1 Cap		50.8
Pier No. 2 Cap		50.8
Pier No. 1 Column	2 @ 3.8	7.6
Pier No. 2 Column	2 @ 3.8	7.6
Total (Cu. Yds.)		612.5

‡ Includes abutment and pier diaphragm concrete above joints; excludes barrier rail concrete.
(F) Note: The concrete for Fiber Reinforced Structural Concrete is included in the quantity "Structural Concrete (Bridge)" shown on Design Sheet 1. The fiber reinforcement for Fiber Reinforced Concrete is paid for separately in the bid item "Fiber Reinforcement for Structural Concrete" shown on Design Sheet 1.

Summary of Reinforcing Steel

Location	Non-Coated Reinforcing Steel	Stainless Steel Reinforcing Steel	Epoxy Coated Reinforcing Steel
Superstructure #		575	91,593
South Abutment Footing	82		2,726
North Abutment Footing	82		2,726
Pier No. 1	18,547		11,769
Pier No. 2	18,132		11,769
Barrier Rail - Two Rails		2,253	4,712
Barrier Rail End Sections		884	1,191
Total (Lbs.)	36,843	3,712	126,486

Includes abutment and pier diaphragm reinforcing above joints; includes wing reinforcing; excludes barrier rail reinforcing.

Summary of Excavation

Location	Class 10 Excavation	Class 20 Excavation
South Abutment	525	75
North Abutment	481	75
Total (Cu. Yds.)	1,006	150

Summary of Foundations

Location	Substructure Type	Foundation Type	Number	Length (Lin. Ft.)	Total (Lin. Ft.)
South Abutment	Integral Abutment Δ	HP10x42	8	50.0	400.0
North Abutment	Integral Abutment Δ	HP10x42	8	55.0	440.0
Pier No. 1	Frame Pier	60" Drilled Shaft	2	53.0	106.0
Pier No. 2	Frame Pier	60" Drilled Shaft	2	51.5	103.0
South Abutment	Integral Abutment Δ	Prebored Holes	8	10.0	80.0
North Abutment	Integral Abutment Δ	Prebored Holes	8	10.0	80.0
Demonstration Shaft	-	60" Drilled Shaft	1	41.5	41.5
				Total HP 10x42 (Lin. Ft.)	840.0
				Total 60" Drilled Shaft (Lin Ft.)	209.0
				Total Demonstration Shaft (Lin Ft.)	41.5
				Total Prebored Holes (Lin. Ft.)	160.0

Δ Non-standard ABC Abutment

Summary of Structural Steel

Location	Total (Lbs.)
6" Diameter Galvanized Corrugated Steel Pipe, Type 1, 16 Gauge	362
Bridge Slab Drains (4 @ 45 Lbs.)	180
Stainless Steel Embedded Plates w/ Headed Shear Studs	1,336
Total (Lbs.)	1,878

Summary of Bearings

Location	Bearing Type	Number	Associated Bid Item
South Abutment	Laminated Neoprene w/ PTFE (Temporary)	8	Incidental*
North Abutment	Laminated Neoprene w/ PTFE (Temporary)	8	Incidental*
South Abutment	Plain Neoprene (Permanent)	8	Incidental**
North Abutment	Plain Neoprene (Permanent)	8	Incidental**
Pier No. 1	Plain Neoprene (Permanent)	8	Incidental**
Pier No. 2	Plain Neoprene (Permanent)	8	Incidental**

* Laminated Neoprene Bearings w/ PTFE are incidental to "Prefabricated Bridge Superstructure Move".
** Plain Neoprene Bearing Pads are incidental to "Structural Concrete (Bridge)".

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans 55'-0" Interior Span

Summary Quantities

STA. 57+50.00 (℄ IA 21) Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 Design Sheet No. 2 of 26 FHWA No. 032601

General Notes:

It is the intent of this design to construct a 140'-0" x 40'-0" continuous concrete slab bridge, skewed 0°, on IA 21 over Cedar Creek at Sta. 57+50.00.

This design is for the replacement of the existing 80'-0" x 30'-0" steel deck girder bridge, Design No. 1448, with a year of construction of 1949. Electronic plans of the existing structure are available to the Contractor as part of the e-files supplied with the contract documents.

The lump sum bid for "Removal of Existing Bridge" shall include all costs associated with removal of the existing 80'-0" x 30'-0" steel deck girder bridge, FHWA No. 032600.

Removals shall be in accordance with Section 2401, of the Standard Specifications.

Faint lines on plans indicate the existing structure.

All plan dimensions are horizontal unless noted otherwise.

Utility companies whose facilities are shown on the plans or known to be within the construction limits shall be notified by the bridge contractor of the construction starting date.

This bridge is designed for HL-93 loading, plus 20 lbs. per square foot of roadway for future wearing surface.

All reinforcing bars and bars noted as dowels supplied for this structure shall be deformed reinforcement unless otherwise noted or shown.

These bridge plans label all reinforcing steel with English notation (5a1 is $\frac{5}{8}$ inch diameter bar). English reinforcing steel received in the field may display the following "Bar Designation". The "Bar Designation" is the stamped impression on the reinforcing bars, and is equivalent to the bar diameter in millimeters.

English Size	3	4	5	6	7	8	9	10	11
Bar Designation	10	13	16	19	22	25	29	32	36

Minimum clear distance from face of concrete to near reinforcing bar is to be 2" unless otherwise noted or shown.

Keyway dimensions shown on the plans are based on nominal dimensions unless stated otherwise. In addition, the bevel used on the keyway shall be limited to a maximum of 10 degrees from vertical.

It shall be the bridge Contractor's responsibility to provide sites for excess excavated material. No payment for overhaul will be allowed for material hauled to these sites.

Contractor shall provide 2 weeks advanced notice to the Iowa DOT's Resident Construction Engineer before critical closure.

The bridge Contractor will be the only Contractor at the site and is responsible for the completion of all work as detailed and noted in these plans.

Class 20 excavation quantites are based on the assumption that the channel excavation is completed prior to starting construction of the abutments.

The bridge Contractor is to clear and/or shape the channel within the approximate limits shown on the "Situation Plan" and "Longitudinal Section Along Centerline IA 21" on Design Sheet 4 and the "Site Plan" on Design Sheet 5.

Concrete barrier rails placed using slipform method will require the use of a Class BR concrete in accordance with Article 2513.03, A, 2, of the Standard Specifications. Cast-in-place barrier rails shall use Class C mix. Class D concrete is not permitted for concrete barrier rails (cast-in-place or slipformed method).

See roadway plans for longitudinal grooving bid items and notes.

See roadway plans for guardrail bid items and notes.

The floor slab as shown includes a $\frac{3}{4}$" wearing surface.

The bridge contractor shall prebore holes for abutment piles. Holes shall be bored to the elevations shown on the "Longitudinal Section Along Centerline IA 21" on Design Sheet 4. Piles shall be driven through the holes to at least the specified nominal axial bearing resistance.

General Notes (Cont.):

A scrape sample was taken from an area of this bridge to get an indication of the existence of and level of total lead and total chromium. Analysis of total lead on this sample was 1100 parts per million (ppm). Analysis of total chromium on this sample was 300 ppm. These analyses show the existence of these two toxic constituents. Levels indicated by these tests could create conditions above regulatory limits for health and safety requirements. No other constituents were analyzed. The bidder should not rely on the Iowa DOT's testing and analysis for any purpose other than as an indication of the existence of these two toxic constituents.

Mechanical Splice Assembly Notes:

The bars in the abutment footings and abutment diaphragms shall be spliced at the locations shown using mechanical splice assemblies, for connection of horizontal wing reinforcing bars after the superstructure move. Mechanical splice assemblies consist of mechanical splicers and reinforcing splice bars as required to facilitate the use of the mechanical splicer. The mechanical splice assembly used shall meet the requirements of Materials IM 451 Appendix E.

The cost of all splice assemblies is to be included in the price bid for "Reinforcing Steel, Epoxy Coated" and no separate payment will be made. The weight of mechanical splice assemblies is not included in the quantity shown for "Reinforcing Steel, Epoxy Coated". The number of epoxy coated splice assemblies required are as follows:
Each Abutment Footing - 12 Assemblies (5n1 & 5n2 Bars) and (5n1 & 5n3 Bars)
Each Abutment Diaphragm - 12 Assemblies (5n1 & 5n2 Bars)

Pocket Voids:

Abutment footings, abutment diaphragms, pier caps, and pier diaphragms shall be constructed with circular voids to allow placement of dowels secured with non-shrink grout after the bridge move. All voids shall be constructed at the locations shown in these plans with 6"∅ CMP. All 6"∅ CMP shall be galvanized corrugated steel pipe, style 1, 16 gage in accordance with Section 4141 of the Standard Specifications and Materials I.M. 441.

Specifications:

Design: AASHTO LRFD Bridge Design Specifications, 10th Ed., Series of 2024.
Construction: Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction, Series 2023, plus applicable General Supplemental Specifications, Developmental Specifications, Supplemental Specifications and Special Provisions shall apply to construction work on this project.
- Developmental Specification for "Fiber Reinforcement for Structural Concrete"
- Developmental Specification for "Construction Progress Schedule"
- Developmental Specification for "Mass Concrete - Control of Heat of Hydration"
  The following elements qualify as mass concrete on this project: Pier Caps.
- Developmental Specification for "Portable Pop-up Network for Inspection Use"
- Special Provisions for "Prefabricated Bridge Superstructure Move"

Working Drawing and Calculation Submittals

Working drawings and calculations shall be submitted for the following items shown in the table below. (Note additional working drawings and calculations may be required in accordance with Article 1105.03 of the Standard Specifications.)

Submittal requirements for working drawings and calculations shall be in accordance with 1105.03 of the Standard Specifications for Highway and Bridge Construction of the Iowa Department of Transportation. The absense of a certification requirement for a submittal does not relieve the Contractor of the responsibility to attain certification.

Calculation submittals in this table which are associated with working drawing submittals shall be submitted on the same day. Review time for calculation submittals shall be of the same duration as and run concurrently with review time for associated working drawings. The calculation submittals listed in the table are not meant to be an exhaustive list and do not relieve the contractor from providing additional calculation submittals if requested by the Engineer.

No.	Working Drawing Description	Working Drawing File Name Convention For Submittal	Certified by Iowa P.E. (Yes/No)
1	Slab Falsework Plans	(46)_Keokuk_Design0326_SlabFalsework.pdf	Yes
2	Slab Drains	(46)_Keokuk_Design0326_SlabDrains.pdf	No
3	Stainless Steel Embedded Diaphragm Plates	(46)_Keokuk_Design0326_StainlessEmbedPl.pdf	No
4	Permanent Neoprene Bearing Pads	(46)_Keokuk_Design0326_PermBearingPads.pdf	No
5	Temporary Laminated Neoprene Bearings	(46)_Keokuk_Design0326_TempBearings.pdf	Yes*
6	Drilled Shaft Installation Plan	(46)_Keokuk_Design0326_DrilledShaftInstall.pdf	No
7	Prefabricated Bridge Superstructure Move	(46)_Keokuk_Design0326_SuperstructureMove.pdf	Yes
8	Acceptance Letter for Temp. Works Const.	(46)_Keokuk_Design0326_AcceptanceLetter.pdf	Yes
No.	**Calculation Description**	**Calculation File Name Convention For Submittal**	**Certified by Iowa P.E. (Yes/No)**
9	Slab Falsework Calculations	(46)_Keokuk_Design0326_SlabFalseworkCalcs.pdf	Yes
10	Prefabricated Bridge Superstructure Move	(46)_Keokuk_Design0326_SuperstructureMoveCalcs.pdf	Yes

*Yes, but only if design deviates from that shown in these plans.

Design Stresses:

Design stresses for the following materials are in accordance with the AASHTO LRFD Bridge Design Specifications, 10th Ed., Series of 2024.
Reinforcing steel in accordance with LRFD AASHTO Section 5, Grade 60, for epoxy and non-coated bars, and Grade 60 or 75 for stainless steel reinforcing.
Concrete in accordance with LRFD AASHTO Section 5, f'c = 4,000 psi.
Structural steel in accordance with LRFD AASHTO Section 6. ASTM A709 Grade 36 or Grade 50 (AASHTO M270 Grade 36 or Grade 50).
n = 8 for tension steel
2n = 16 for compression steel
HL-93 live load plus 20 lbs. per sq. ft. for future wearing surface.
End span length is used to calculate equivalent width in live load distribution.
Six foot of approach slab dead & live load included in abutment loads.
Control of cracking by distribution of reinforcement for slab design based on the AASHTO LRFD Bridge Design Specifications, 10th Ed., Series of 2024.

Value Engineering Proposals:

Contractors may develop alternative construction proposals that allow the state to benefit from reduced costs, while maintaining the same or reduced ABC construction schedule for the project. The Contractor shall also perform any necessary redesign of bridge components resulting from the changes. Only alternate designs that utilize a prefabricated bridge constructed off-alignment and moved to the final position will be accepted for review under the value engineering proposal. The design must provide the required performance, reliability, quality and constructability.

Changes to the prefabricated bridge superstructure move system (E.G. PTFE slide, rollers, SPMT, heavy lift) are not subject to the cost savings sharing requirements of value engineering propsals and shall be submitted per the requirements of the Special Provision for Prefabricated Bridge Superstructure Move.

Minimum Age for Concrete Loading Notes:

All concrete pours on the critical path during the critical closure period shall require the use of maturity method as described in Article 2403.03, N, 2 of the Standard Specifications and Materials I.M. 383. The maturity method will be used to determine the minimum age for loading based on strength requirements only. All costs associated with implementing the maturity method will not be paid for separately, but will be incidental to "Structural Concrete (Bridge)".

Bridge Slab Dimensions Table

No.	Item	Unit	Quantity
1	Slab Length	L.F.	141.3
2	Minimum Slab Width	L.F.	43.2
3	Maximum Slab Width	L.F.	43.2
4	Slab Area	S.F.	6,105

1. Slab length is measured from face-to-face of paving notches along the centerline of roadway.
2, 3. Slab widths are measured from out-to-out of slab perpendicular to the centerline of roadway.
4. Slab area is to be based on the face-to-face paving notch distance and out-to-out slab dimensions.

Design History at This Site

Des. No.	Type of Work
1448	Original Design
188	Bridge Deck Overlay
---	Scour Countermeasures (2005)
---	Bridge Painting (2020)
120	Retrofit Rail End Sections

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans 55'-0" Interior Span

General Notes

STA. 57+50.00 (℄ IA 21) Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 Design Sheet No. 3 of 26 FHWA No. 032601

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER V.3	

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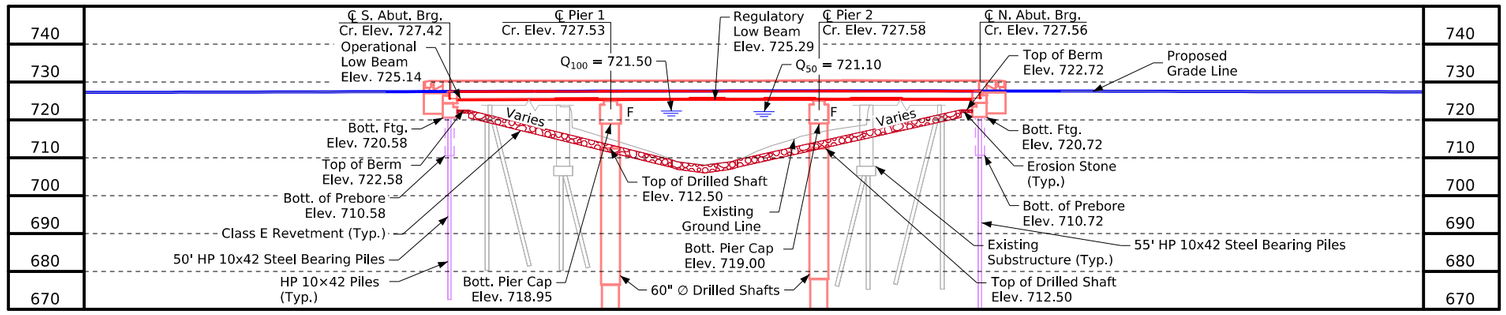
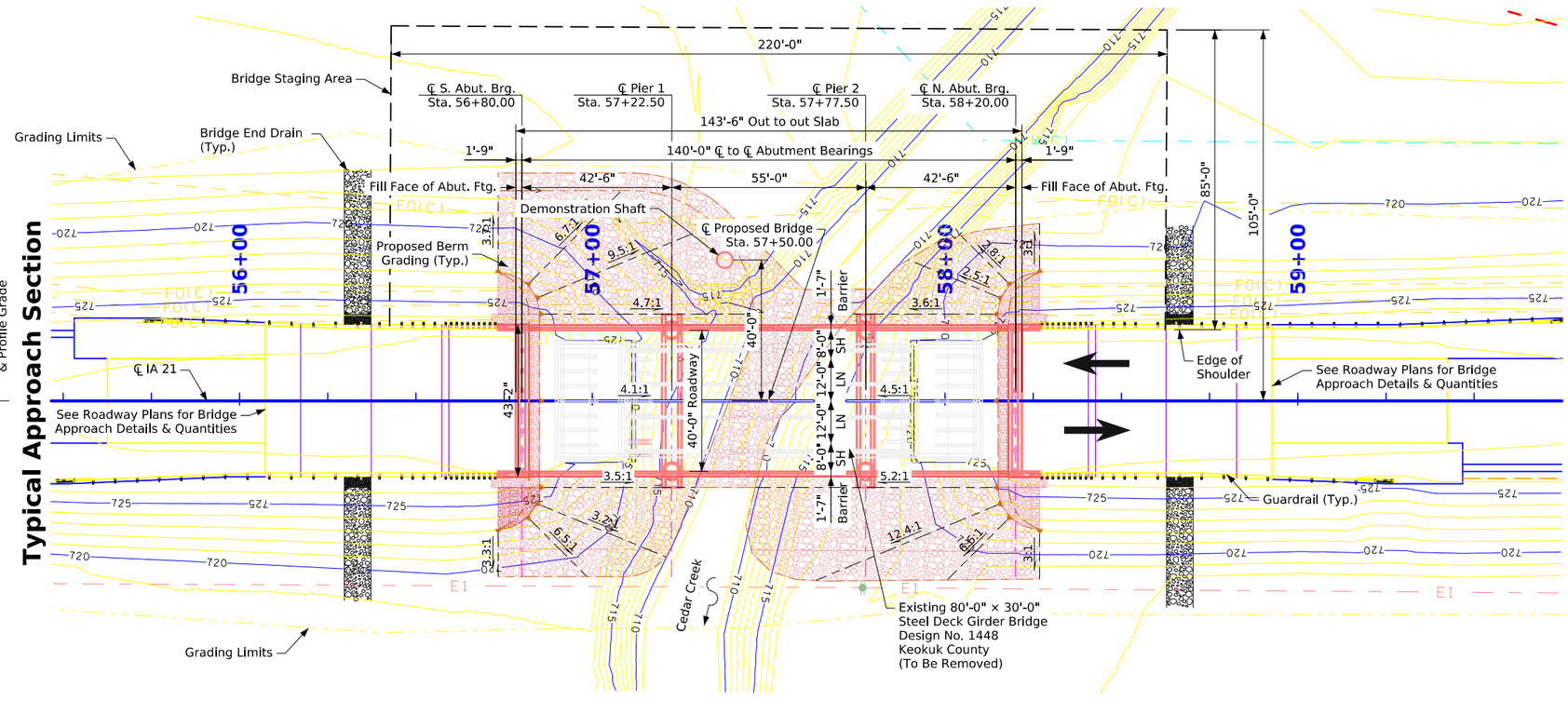
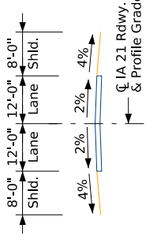


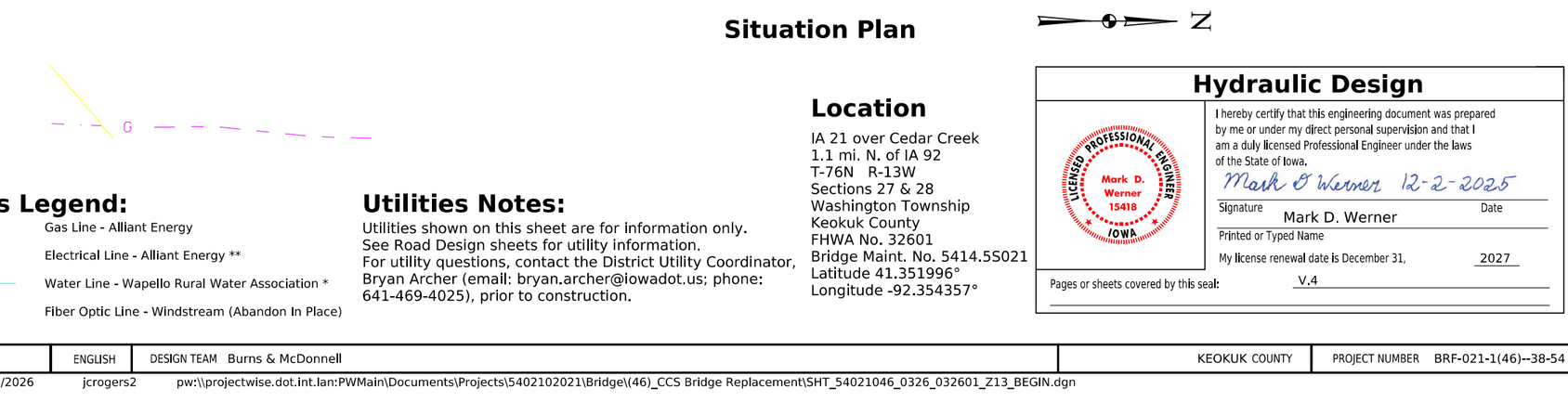
Longitudinal Section Along ℄ Iowa 21



Typical Approach Section



Situation Plan



Utilities Legend:

- G — Gas Line - Alliant Energy
- E1 — Electrical Line - Alliant Energy **
- W(C) — Water Line - Wapello Rural Water Association *
- FO(C) — Fiber Optic Line - Windstream (Abandon In Place)

Utilities Notes:

Utilities shown on this sheet are for information only.
See Road Design sheets for utility information.
For utility questions, contact the District Utility Coordinator, Bryan Archer (email: bryan.archer@iowadot.us; phone: 641-469-4025), prior to construction.

Location

IA 21 over Cedar Creek
1.1 mi. N. of IA 92
T-76N R-13W
Sections 27 & 28
Washington Township
Keokuk County
FHWA No. 32601
Bridge Maint. No. 5414.5S021
Latitude 41.351996°
Longitude -92.354357°

Hydraulic Design

LICENSED PROFESSIONAL ENGINEER
Mark D. Werner
15418
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Mark D Werner 12-2-2025

Signature Date

Mark D. Werner

Printed or Typed Name

My license renewal date is December 31, 2027

Pages or sheets covered by this seal: V.4

BENCH MARK NO. CP3: N:6801790.67 E:23379896.47; ELEV 719.57
SET ⅝" REBAR ON THE SOUTHEAST SIDE OF THE BRIDGE ON THE SOUTH SIDE OF THE CREEK BANK

VPI Sta. 57+83.16
VPI Elev. = 727.74

G1 = 0.278% G2 = -0.278%

VPC Sta. 56+93.16
VPC Elev. = 727.49

VPT Sta. 58+73.16
VPT Elev. = 727.49

Proposed Profile Grade IA 21

(Note: the vertical profile is in a 0.2679% tangent near the South abutment. See Roadway Sheets for additional profile information.)

Hydraulic Data

RIDB: CedarC_Keo_12.0
Drainage Area = 24.9 Sq. Mi.
Stream Slope (HGL) = 8.9 Ft./Mi.
Avg. Low Water Stage = 709.5
Channel Low Beam = 725.25

Q_{50} = 3,200 cfs
Stage = 721.1
Avg. Bridge Velocity = 6.2 fps

Q_{100} = 3,780 cfs
Stage = 721.5
Backwater = 1.1 Ft.
Avg. Bridge Velocity = 6.9 fps

Q_{200} = 4,400 cfs
Stage = 721.9
Calculated Design Scour = 697.2

Q_{500} = 5,260 cfs
Stage = 722.5
Avg. Bridge Velocity = 8.6 fps
Calculated Check Scour = 696.0

Notes

Top of slab crown (Cr.) elevation at ℄ roadway is 0.03' below the profile grade to account for parabolic crown.
All units are in feet unless otherwise noted.
Accelerated Bridge Construction (ABC) sequence is intended, using temporary supports and a prefabricated bridge superstructure move. See Bridge Staging Plan on Design Sheet 6.
The overhead power line was determined by Alliant Energy to be located at an adequate offset as to not be impeded by the construction activities. Contractor to inform the Engineer if their equipment will need to be located within a 10 ft clearance envelope of the energized overhead power line.
* Water Line will be relocated by Wapello Rural WaterAssociation where its location conflicts with the Bridge Staging Area.
** The existing overhead power line will be relocated by others prior to the drilled shaft construction at east side of the bridge.

Design For 0° Skew
140'-0" × 40'-0" Continuous
Concrete Slab Bridge
42'-6" End Spans 55'-0" Interior Span

Situation Plan
STA. 57+50.00 (℄ IA 21) Turn-in Date: April 2026

Keokuk County
IOWA DEPARTMENT OF TRANSPORTATION
Design No. 0326 Design Sheet No. 4 of 26 FHWA No. 032601

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER V.4

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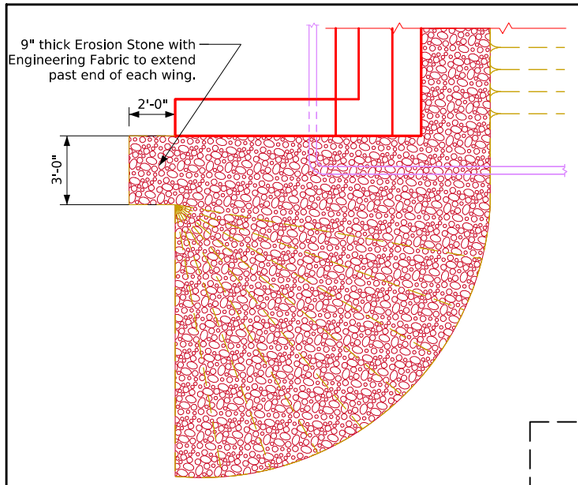
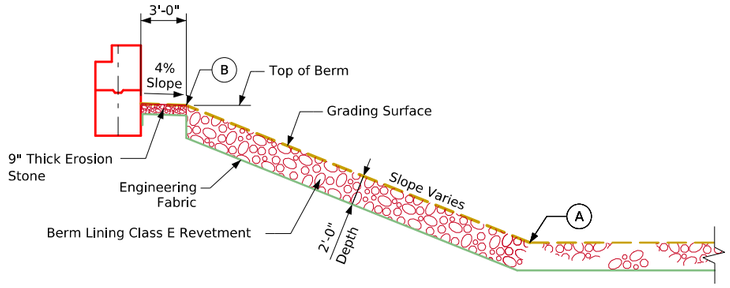


Detail A



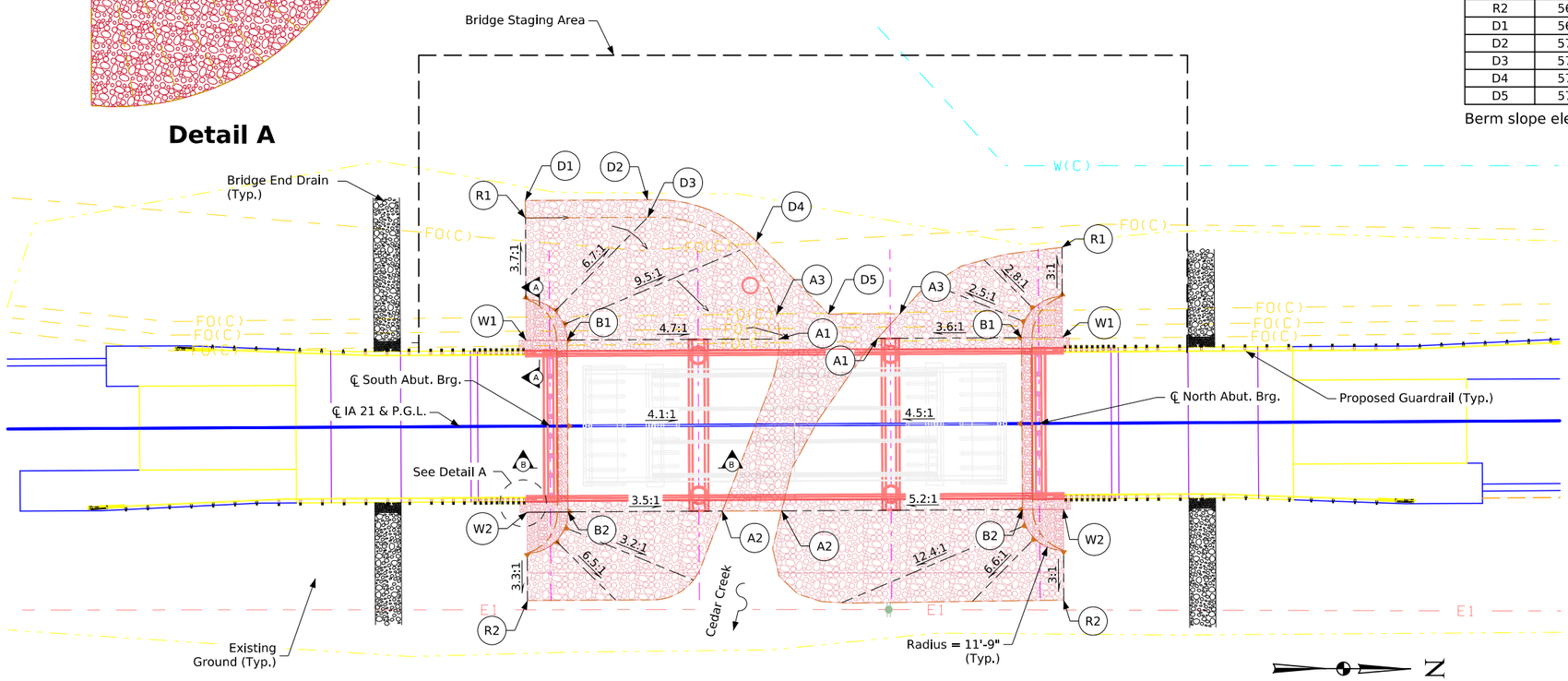
Section B-B

BENCH MARK NO. CP3: N:6801790.67 E:23379896.47; ELEV 719.57
SET $\frac{5}{8}$" REBAR ON THE SOUTHEAST SIDE OF THE BRIDGE ON THE SOUTH SIDE OF THE CREEK BANK

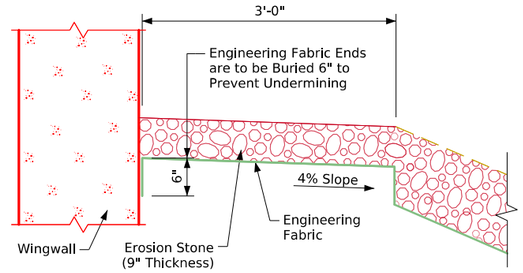
Berm Slope Location Table

Points	South Abutment			North Abutment		
	Station	Offset	Elev.	Station	Offset	Elev.
A1	57+45.70	24.58' LT	709.60	57+73.86	24.58' LT	711.15
A2	57+29.16	24.58' RT	710.11	57+46.12	24.58' RT	709.45
A3	57+44.99	31.58' LT	712.06	57+80.28	31.58' LT	710.04
B1	56+85.00	24.58' LT	722.58	58+15.00	24.58' LT	722.72
B2	56+85.00	24.58' RT	722.58	58+15.00	24.58' RT	722.72
W1	56+73.25	24.58' LT	726.70	58+26.75	24.58' LT	726.85
W2	56+73.25	24.58' RT	726.70	58+26.75	24.58' RT	726.85
R1	56+73.25	59.58' LT	717.47	58+26.75	50.34' LT	718.58
R2	56+73.25	49.85' RT	719.32	58+26.75	50.51' RT	718.65
D1	56+73.25	64.58' LT	717.85	-	-	-
D2	57+10.70	64.58' LT	717.24	-	-	-
D3	57+10.70	59.58' LT	717.14	-	-	-
D4	57+39.27	52.58' LT	716.89	-	-	-
D5	57+59.85	31.58' LT	708.39	-	-	-

Berm slope elevations reflect the grading surface.



Site Plan



Section A-A

General Notes:

The bridge berm foreslope shall be compacted and shaped as shown on these plans, the Situation Plan, and as directed by the Engineer. The berm foreslope shall be firm when the Engineering Fabric, Erosion Stone and Class E Revetment are placed.

Erosion stone shall be placed along the sides of the wings and abutment footing as shown in Section A-A. This is typical at each corner of the bridge unless otherwise noted in the plans. Erosion stone shall also be placed along the top of the berms as shown in Section B-B. The erosion stone and Class E Revetment shall be underlayed with engineering fabric in accordance with Article 4196.01, B, 3, of the Standard Specifications. If the fabric is lapped, the laps shall be a minimum of one foot in length, placed in shingle fashion with the upslope lap piece on top and stapled for continuity.

The erosion stone shall be in accordance with Section 4130, of the Standard Specifications.

The erosion stone shall be deposited, spread, consolidated and shaped by mechanical or hand methods that will provide uniform 9 inch depth and density and provide uniform surface appearance.

Estimated Berm Armoring Quantities

Location	Revetment CL. E (Ton)	Erosion Stone (Ton)	Engineering Fabric (SY)	CL. 10 Channel Excavation (CY)
Berm Lining - South	782	19	860	525
Berm Lining - North	709	19	781	481
Totals	1491	38	1641	1006

Excavation quantity calculated from grading surface.
Excavation quantity is for embedded revetment and erosion stone core out only, and does not include excavation to the grading surface. Excavation quantity to the grading surface is determined by Road Design and included in the Road Plans.
Class E revetment based on density of 1.5 ton/CY.
Erosion stone based on density of 1.6 ton/CY.

Utilities Notes:

Utilities shown on this sheet are for information only. See Road Design sheets for utility information.
* Water Line will be relocated by Wapello Rural Water Association where its location conflicts with the Bridge Staging Area.
** The existing overhead power line will be relocated by others prior to the drilled shaft construction at east side of the bridge. For utility questions, contact the District Utility Coordinator, Bryan Archer (email: bryan.archer@iowadot.us; phone: 641-469-4025), prior to construction.

Utilities Legend:

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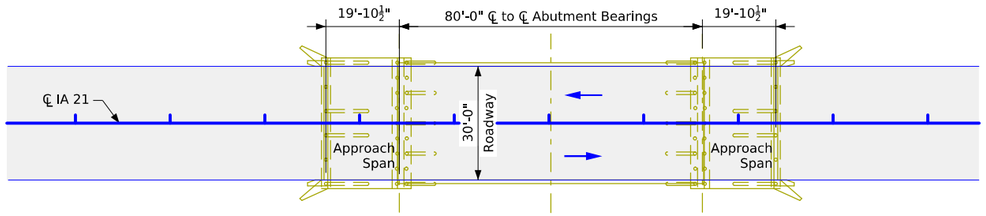
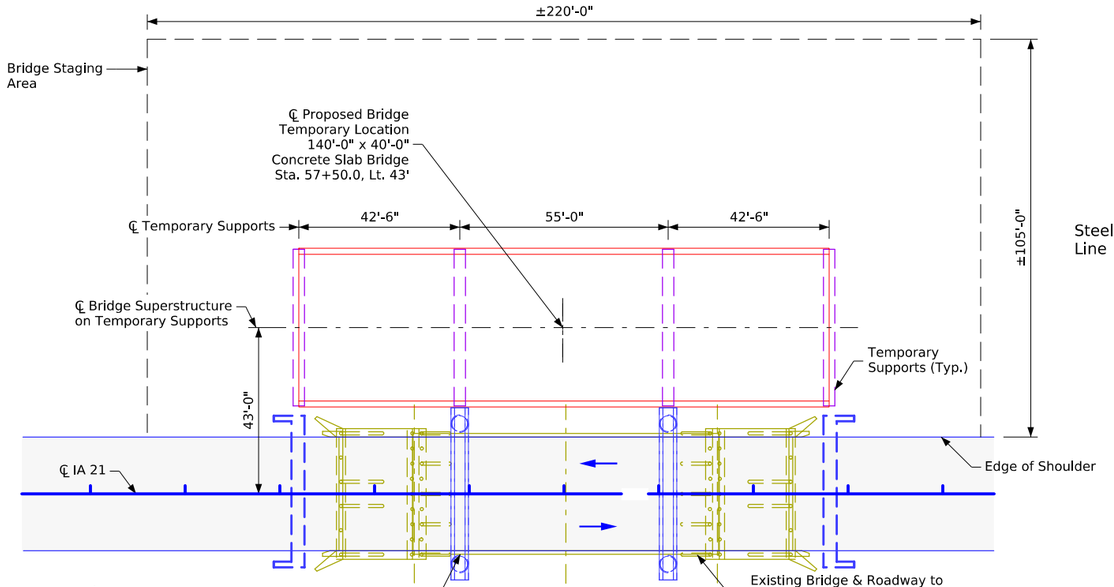
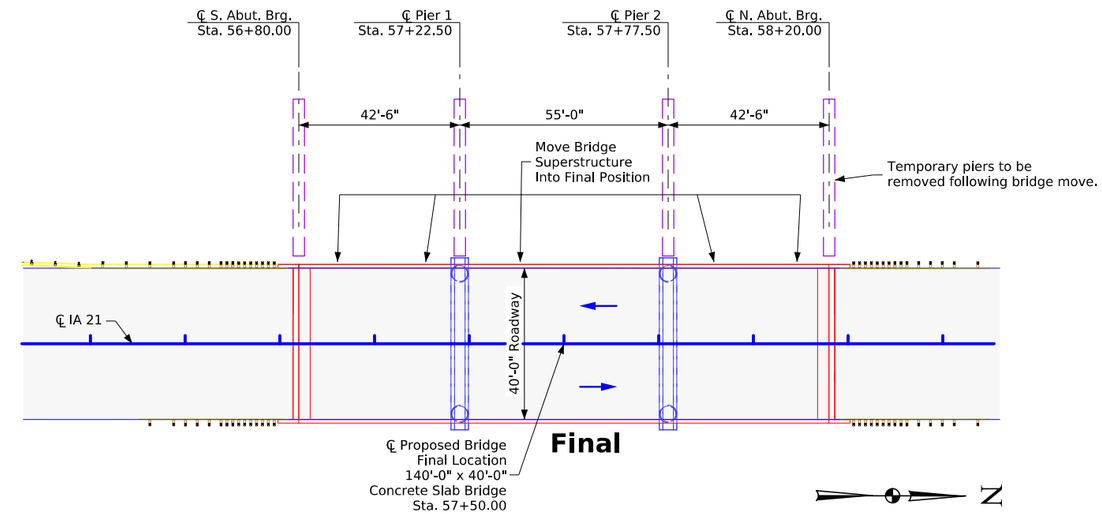
Design For 0° Skew
140'-0" × 40'-0" Continuous Concrete Slab Bridge
42'-6" End Spans 55'-0" Interior Span
Site Plan
STA. 57+50.00 (℄ IA 21) Turn-in Date: April 2026
Keokuk County
IOWA DEPARTMENT OF TRANSPORTATION
Design No. 0326 Design Sheet No. 5 of 26 FHWA No. 032601



Existing Condition



Stage 1

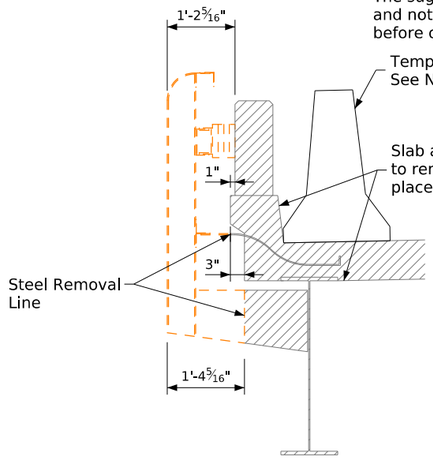


Final

Suggested Construction Sequence for Critical Closure:

1. Demolish Existing Bridge.
2. Berm Grading / Drive Piling / Place Revetment
3. Place Abutment Footing / Pier Caps
4. Move Prefabricated Bridge Superstructure
5. Place Wingwalls
6. Place Backfill Behind Abutments
7. Bridge Approach Slab
8. Paved Shoulder / Guardrail / Longitudinal Grooving

The suggested construction sequence for critical closure is a general list of major activities and not an exhaustive list of all necessary activities. Barrier Rails may be constructed either before or after Prefabricated Bridge Superstructure Move.



Existing Bridge Railing Removal Detail

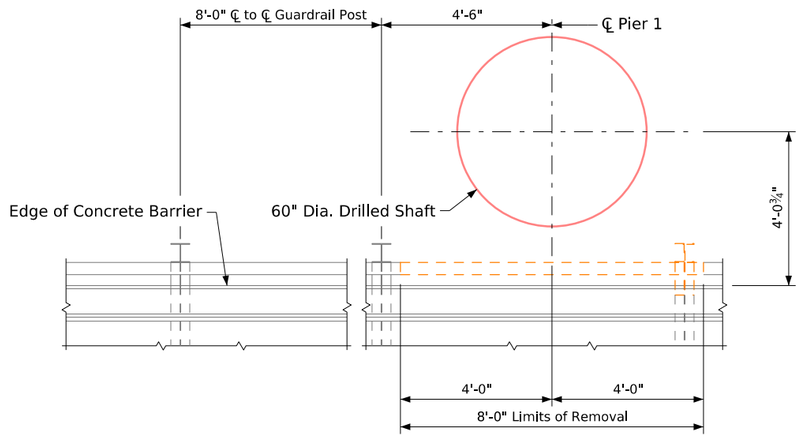
NOTES:
At the Contractor's option, partial removal of the steel rail and posts will be allowed to facilitate drilled shaft construction. Traffic will be maintained on the existing bridge during and following the partial removal. The Contractor shall submit to the Engineer for approval a partial removal plan before beginning removal operations.

The partial removal plan will show the location and proposed extent of the partial removal, how the removed area will be protected with Temporary Barrier Rail and include all traffic control required during and following removal.

The cost for the partial removal will be considered incidental to the bid item "Removal of Existing Bridge" and no direct payment will be made. Refer to the traffic control plan shown elsewhere in these plans.

The steel overhang brackets shall be cut at the locations noted; no removal of connectors at the girder webs shall be allowed.

** TBR should be placed before the steel rail removal; if the Contractor determines that partial removal of the steel rail as shown is not necessary for the drilled shaft construction, TBR does not need to be placed on the bridge. Refer to Roadway plan sheet B.3 for additional information.



Existing Bridge Railing Removal Detail - Plan View

(Verify all dimensions in the field)
(West Drilled Shaft Shown, East Drilled Shaft Similar)

Notes:

* Removal of sections of existing steel rail shall be completed via access from below the bridge such that traffic operations are not impeded prior to the critical closure period.

Grade creek to maintain creek flow around temporary bent locations. Restore creek channel to pre-construction contours after removal of temporary bent piles.

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans — 55'-0" Interior Span

Bridge Staging Plan

STA. 57+50.00 (℄ IA 21) — Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 — Design Sheet No. 6 of 26 — FHWA No. 032601

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER V.6

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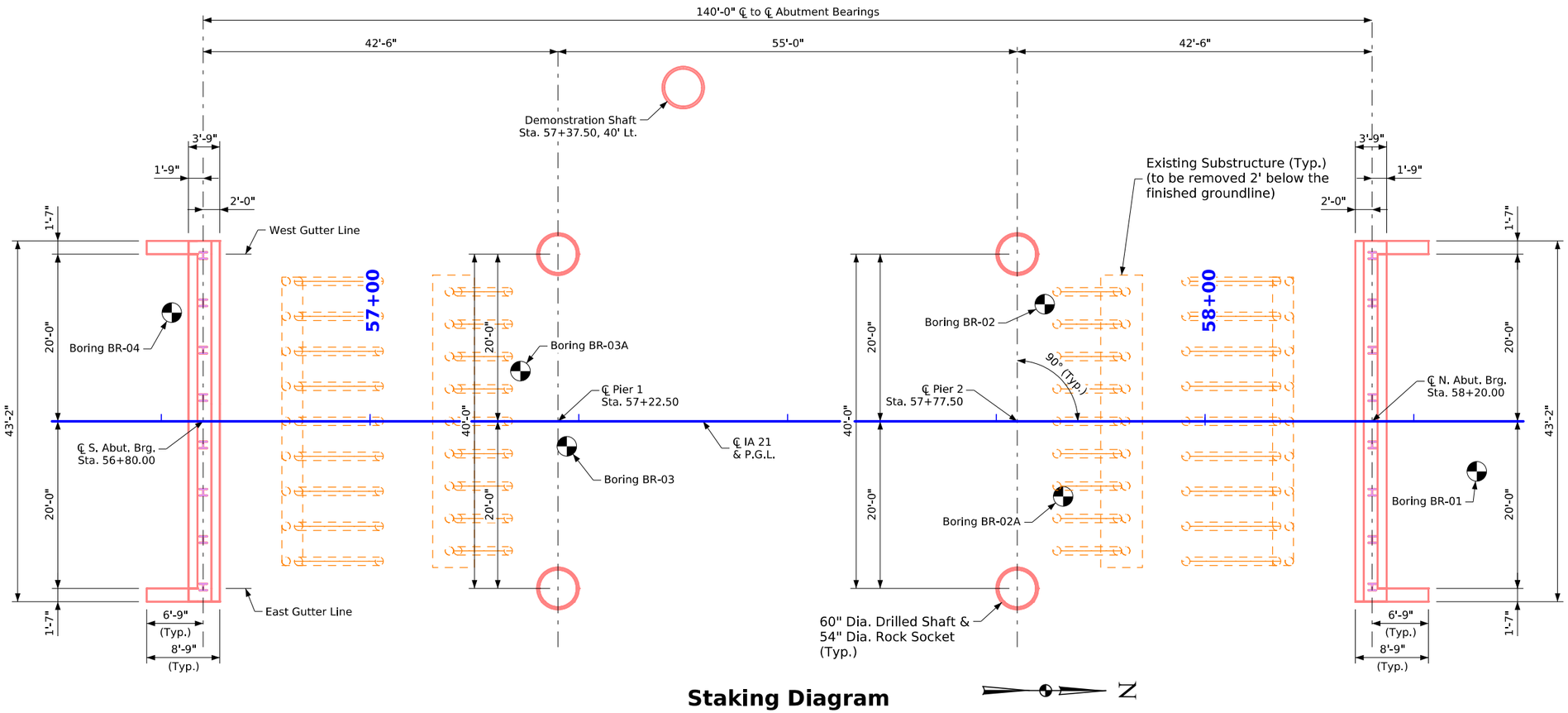
BENCH MARK NO. CP3: N:6801790.67 E:23379896.47; ELEV 719.57
SET ⅝" REBAR ON THE SOUTHEAST SIDE OF THE BRIDGE ON THE SOUTH SIDE OF THE CREEK BANK



Staking Diagram

Bridge Coordinates

Location	℄ S. Abut. Brg.	℄ Pier 1	℄ Pier 2	℄ N. Abut. Brg.
West Edge of Slab	E = 23379810.226 N = 6801774.827	E = 23379810.000 N = 6801817.326	E = 23379809.707 N = 6801872.326	E = 23379809.481 N = 6801914.825
℄ IA 21 & P.G.L.	E = 23379831.809 N = 6801774.942	E = 23379831.583 N = 6801817.441	E = 23379831.290 N = 6801872.440	E = 23379831.064 N = 6801914.940
East Edge of Slab	E = 23379853.392 N = 6801775.057	E = 23379853.166 N = 6801817.556	E = 23379852.873 N = 6801872.555	E = 23379852.647 N = 6801915.055

Note: an electronic file containing the bridge coordinate data is available as part of the e-files supplied with the contract documents. The Contractor shall verify these coordinates with the project horizontal control information provided in the road plans.

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans — 55'-0" Interior Span

Staking Diagram

STA. 57+50.00 (℄ IA 21) — Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 — Design Sheet No. 7 of 26 — FHWA No. 032601

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER V.7

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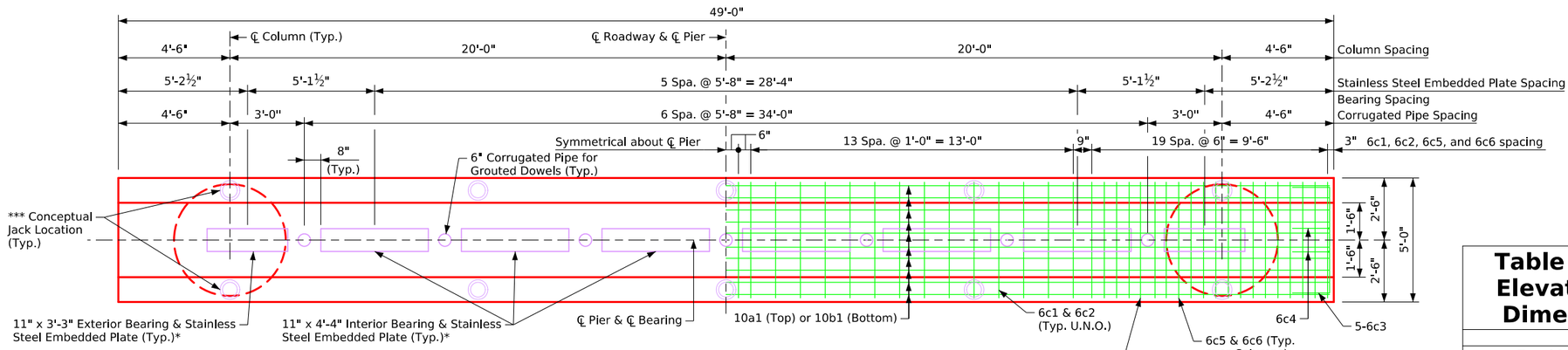
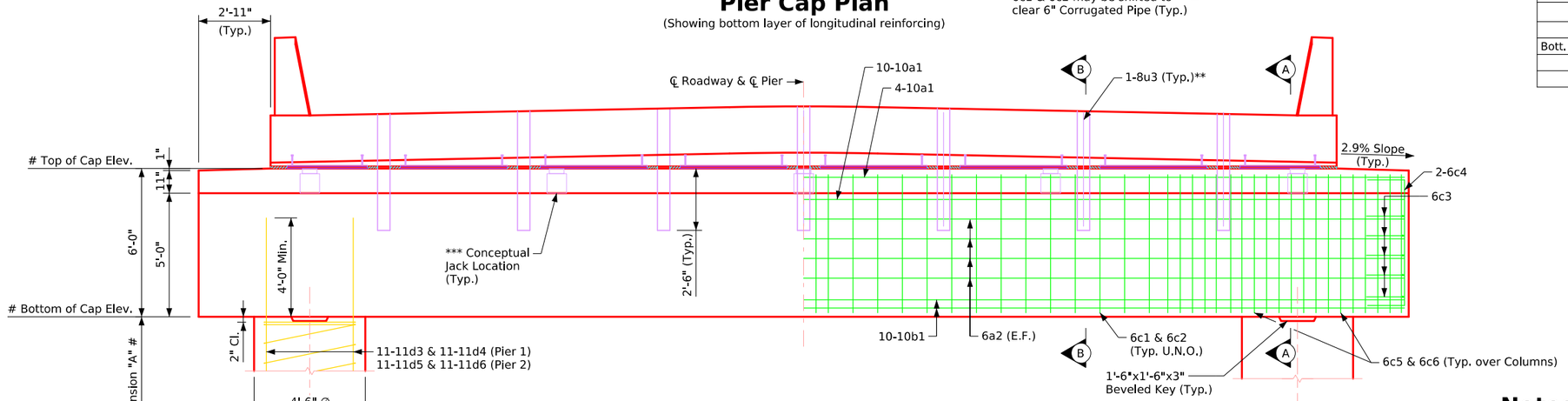
Bench Mark No. CP3: N: 6801790.67 E: 23379896.47, Elev. 719.57
Set ⅝" Rebar on the Southeast Side of the Bridge on the South Side of the creek bank.



Pier Cap Plan

(Showing bottom layer of longitudinal reinforcing)



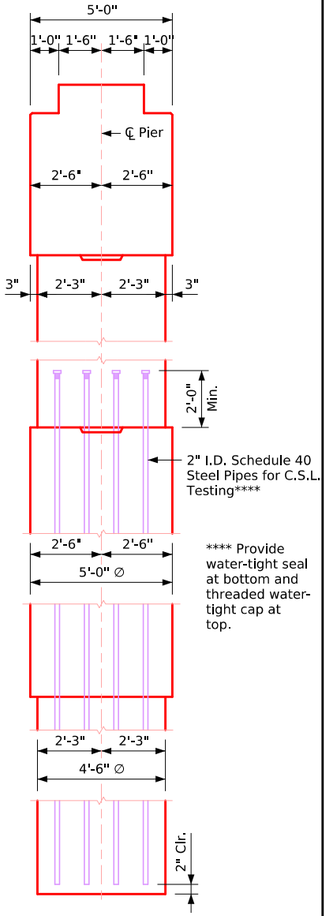
See table of Pier Elevations & Dimensions, this sheet.

Pier Elevation

(Slab and Diaphragm Reinforcing not shown.
See Superstructure Design Sheets 17-20.)

Table of Pier Elevations & Dimensions

	Pier 1	Pier 2
Top of Cap	724.95	725.00
Bott. of Cap	718.95	719.0
Top of Shaft	712.50	712.50
Bott. of Rock Socket	659.50	661.00
Dimension "A"	6'-5⅜"	6'-6"
Dimension "B"	53'-0"	51'-6"



End Elevation

Notes:

For Section A-A, Section B-B, and Cap End Reinforcing, see Design Sheet 9.

For Sections Through Column and Drilled Shaft, as well as lap information for vertical bars in Drilled Shaft, see Design Sheet 10.

For additional Pier Notes, see Design Sheet 10.

* Stainless Steel Embedded Plate is to be cast in the superstructure diaphragm. Stainless Steel Embedded Plates to be deleted if roller move is utilized.

** For corrugated pipe and dowel notes, see Design Sheet 15.

*** Conceptual jack locations are shown. The actual number of jacks and spacings shall be the responsibility of the Contractor and shall be supported by calculations sealed by a Professional Engineer licensed in the State of Iowa. See Special Provision for "Prefabricated Bridge Move".

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans — 55'-0" Interior Span

Pier Details

STA. 57+50.00 (℄ IA 21)

Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 — Design Sheet No. 8 of 26 — FHWA No. 032601

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER V.8

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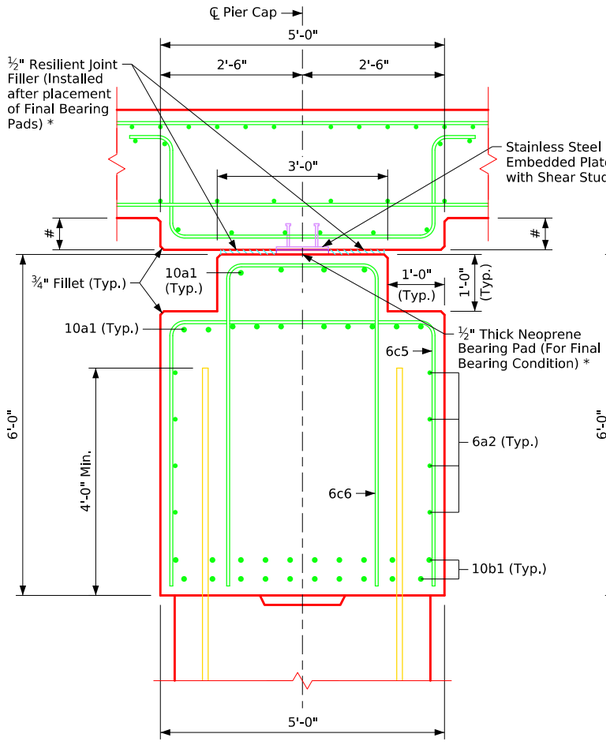
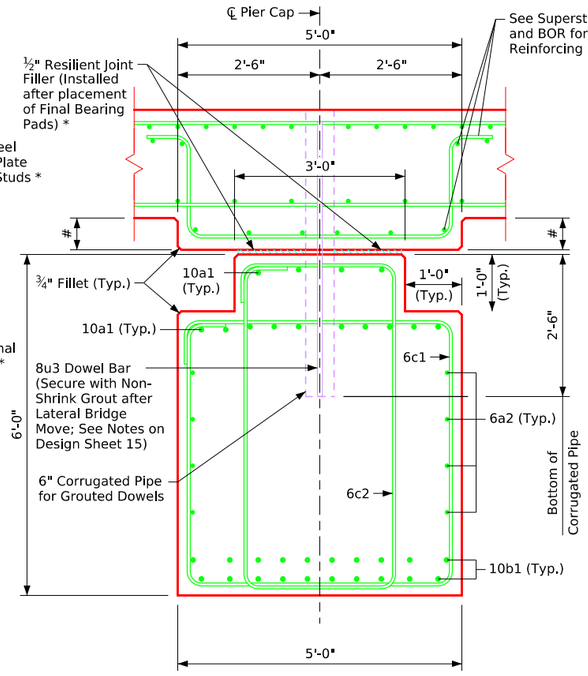


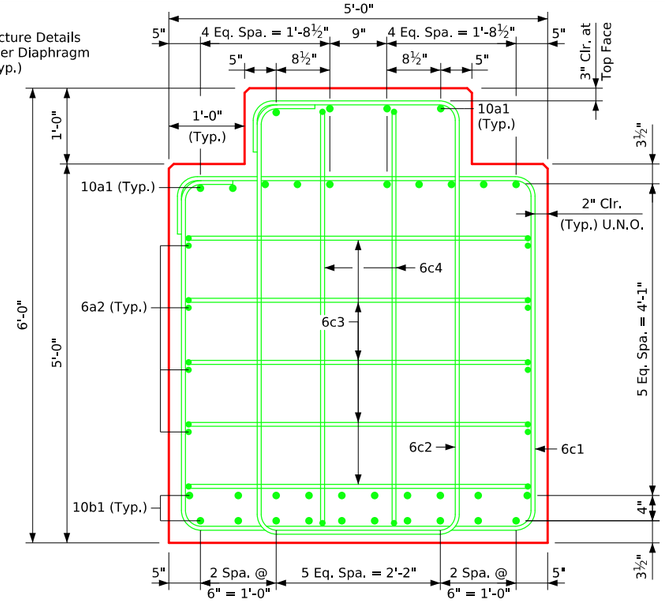
Section A-A

(See Cap End View for longitudinal bar spacing)
(Spiral not shown for clarity)

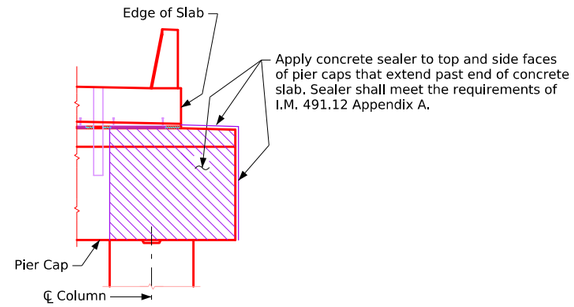


Section B-B

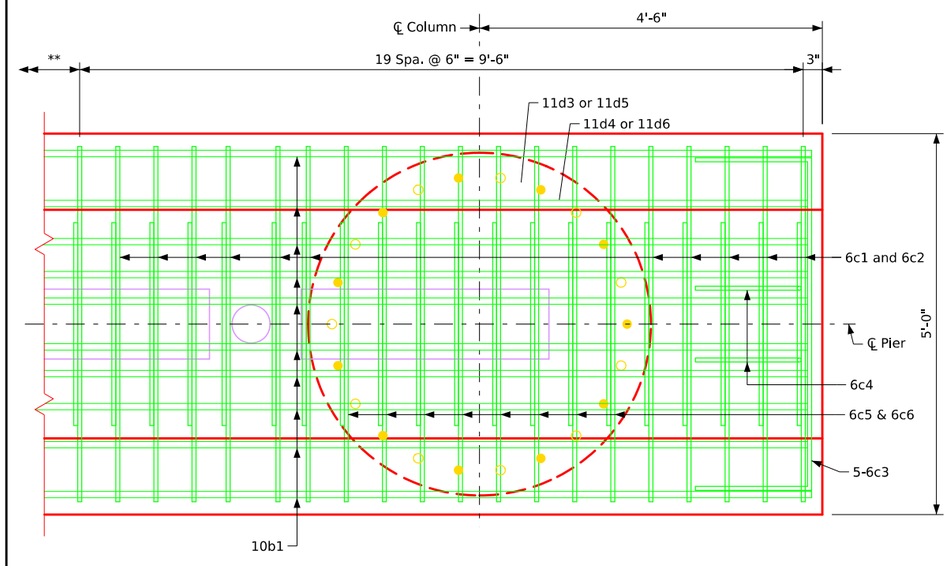
(See Cap End View for longitudinal bar spacing)



Cap End View

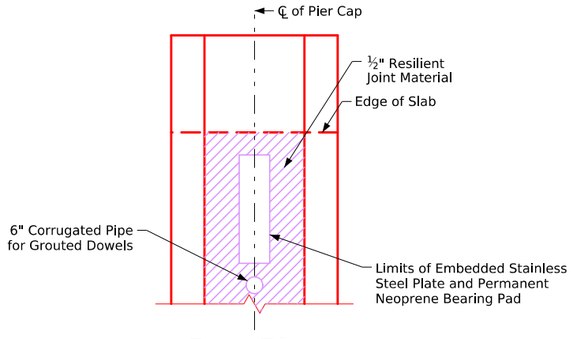


Pier Cap Concrete Sealer Detail



Cap End Reinforcing Detail

(Showing bottom layer of longitudinal reinforcing)



Part Plan

Showing treatment of ½" resilient joint material around bearings.

Notes:

For locations of Section A-A, B-B and Cap End View, see Design Sheet 8.

* Temporary bearings with bonded PTFE top surface and embedded stainless steel plates in diaphragms are required for a pad-type lateral slide. If rollers are instead used for the lateral slide, temporary bearings and embedded stainless steel plates are not required. See details on Design Sheet 16.

** See Pier Cap Plan Design Sheet 8.

\# Varies, see Design Sheet 17 for additional information.

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans — 55'-0" Interior Span

Pier Details

STA. 57+50.00 (℄ IA 21)

Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 — Design Sheet No. 9 of 26 — FHWA No. 032601

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER V.9

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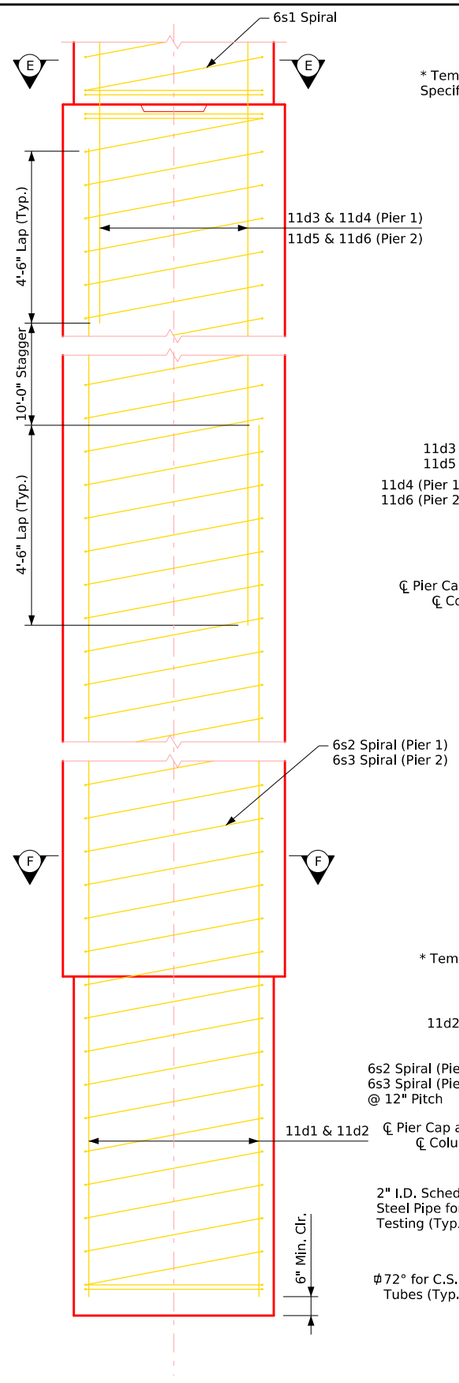
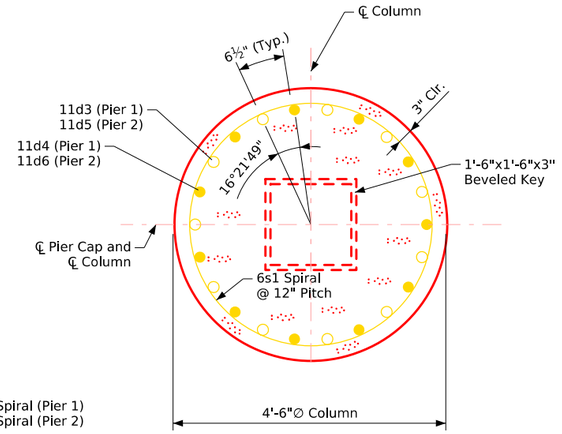
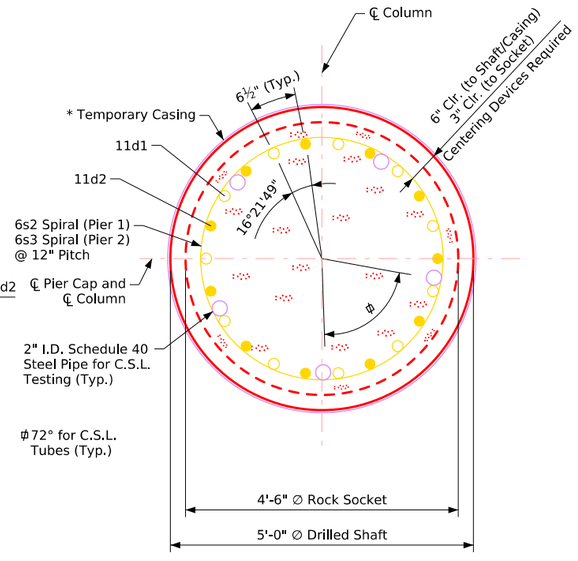


* Temporary Casing if required, see Standard Specifications Section 2433.



Section E-E



Section F-F

Drilled Shaft Reinforcing Splice Detail at Piers

Pier Notes:

All exposed corners 90° or sharper are to be filleted with a 3/4" dressed and beveled strip.

Minimum clear distance from face of concrete to near reinforcing bar is to be 2 inches unless otherwise noted or shown.

Reinforcing shall be securely wired in place before concrete is placed. No exceptions to this requirement shall be permitted.

Spiral reinforcing is to be No. 6 bar (Columns and Shafts), with pitches as shown in these plans. Place 4 equally spaced L ⅞" x ⅞" x ⅛" spacers punched to hold spirals. Spirals are to have 1½ extra turns at top and bottom of columns and shafts.

The spiral reinforcing may be spliced by lapping 3'-1" (#6 bar). The length of spiral shown does not include the lapped length of the splices. The cost of the laps at splices shall be incidental to the bid item "Reinforcing Steel".

The spiral reinforcing may be substituted with circular ties spaced at the same intervals as the spiral reinforcing noted in these plans. Payment will be based on the weight of the spiral reinforcement. No adjustments in reinforcing steel pay weightwill be allowed. See bent bar details for bar size and splice lap length.

Article 4151.03, A, 2, of the Standard Specifications shall not be permitted for spiral reinforcement.

Forms for Pier Caps on Piers 1 & 2 may be removed with the approval of the Engineer when the following two conditions have been met:
1) Pier Cap concrete has been in place for a minimum of 5 calendar days, excluding days that the concrete surface is subjected to temperatures at or below 40°f.
2) The Pier Cap concrete strength is at least 2.50 ksi

Concrete strength shall be verified by flexural strength according to Materials I.M. 316 or by the maturity method according to Materials I.M. 383. Curing of Pier Cap concrete shall be in accordance with the Standard Specifications. Pier Cap concrete shall attain a minimum concrete strength of 4.00 ksi before being subjected to exterior loads, including superstructure jacking or sliding loads. Pier Cap concrete shall be subjected to exterior loads in accordance with Article 2403.03, N, of the Standard Specifications.

Concrete Sealer is to be applied to the Pier Caps as shown on Design Sheet 9 in accordance with the Standard Specifications. The cost of furnishing and placing Concrete Sealer is to be included in the price bid for "Structural Concrete (Bridge)".

Contractor may remove a section of existing bridge steel rail and posts to provide clearance for drilled shaft and column construction. See optional Existing Bridge Railing Removal Detail and notes on Design Sheet 6.

Drilled Shaft Notes:

Drilled Shaft Axial Resistance is intended to be developed through skin friction between the shaft and the limestone and shale materials indicated in the soil boring logs. Minimum Rock Socket depth into competent rock shall be as shown on Design Sheet 11. If differing site conditions are encountered, adjustment to the contract length may be required.

If the contract length of the Drilled Shafts must be increased by 6" or less, the rebar cage shall remain at the elevation shown in the plans. The clear space from the bottom of cage to bottom of shaft may be increased from 6" up to a maximum of 12". The C.S.L. Tubes shall be lowered to maintain 2" clear from the bottom of the shaft.

If the contract length of the drilled shafts must be increased by more than 6", the rebar cage must be lengthened. the contractor has the option to either:
1) Provide longer vertical bars without introducing an additional splice, or
2) Lengthen the vertical bars using contact lap or mechanical splices. Minimum contact lap splice length shall be 4'-6". Splices shall be alternated such that 50% of the bars are spliced at the bottom of the shaft and the remaining 50% are spliced at the top of the shaft. Splice locations shall be a minimum of 10 feet apart.
Regardless of which option is selected, the spiral reinforcing shall be lengthened to extend from top to bottom of rebar cage at the pitch called out in the plans. 1½ extra turns shall be provided at top and bottom of cage. Spirals may be lap spliced as described in the notes.

Drilled Shafts shall be constructed in accordance with Section 2433 of the Standard Specifications. Excavation method shall be determined by the Contractor from the approved methods listed in the Specification and shall be subject to the Engineer's approval. Dry excavation methods will not be allowed. Safety and constructability of the excavation shall be the responsibility of the Contractor. Temporary excavation casing may be required. Refer to the Soil Profile Sheets shown elsewhere in these plans.

The price bid for "Concrete Drilled Shaft, 60 in. Diameter" shall include all costs of materials and labor for excavation and concrete placement and all costs for C.S.L. testing.

Crosshole Sonic Log (C.S.L.) testing shall be required at each Drilled Shaft. Testing shall be in accordance with Article 2433.03, J, of the Standard Specifications.

Drilled Shaft Rock Sockets shall be brushed. Grooving shall be required in shale material and not required in limestone material.

The total factored axial load for each drilled shaft is 1,149 kips.

Demonstration Shaft Notes:

Demonstration Shaft shall conform to details for the 60 inch diameter Drilled Shaft on Design Sheets 8-11. Demonstration Shaft shall be constructed at the location shown on Design Sheet 4. Demonstration Shaft shall extend to the elevations shown on Design Sheet 11, and shall extend a minimum of 3 ft. into rock. Length of Rock Socket shall be determined by a boring at the location of the Demonstration Shaft.

Demonstration shaft shall be removed to at least 3 feet below finished grade, unless it conflicts with the temporary works for the 'Prefabricated Bridge Superstructure Move'. The Contractor has the option to incorporate the demonstration shaft into their temporary works, or propose an alternate location for the demonstration shaft, to avoid conlfict with the temporary works.

All costs noted as incidental to "Concrete Drilled Shaft, 60 in. Diameter" shall also be incidental to the bid item "Demonstration Shaft." The bid price should also include the cost for the reinforcement in the Demonstration Drilled Shaft.

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans — 55'-0" Interior Span

Drilled Shaft & Pier Details & Notes

STA. 57+50.00 (℄ IA 21)

Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 | Design Sheet No. 10 of 26 | FHWA No. 032601

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER V.10

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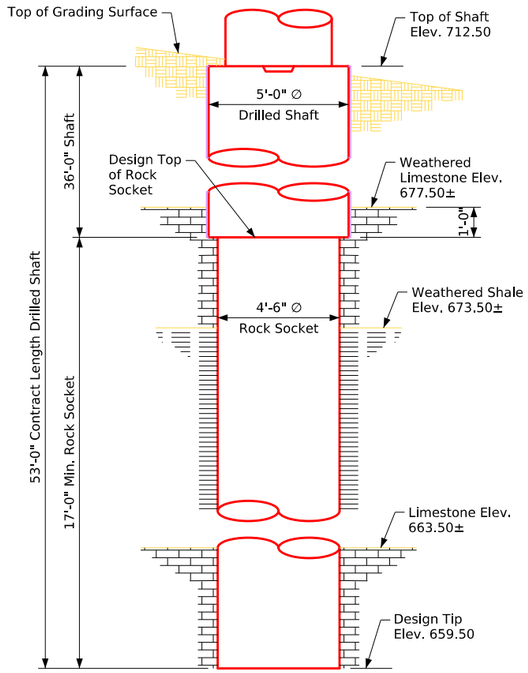
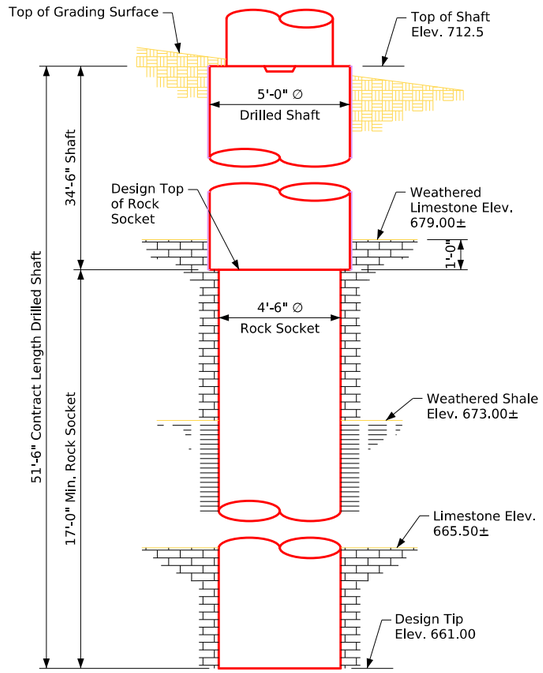
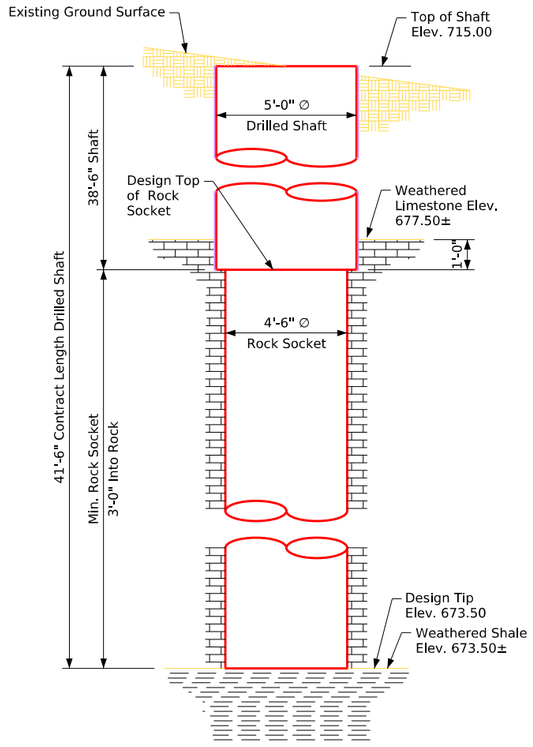
BENCH MARK NO. CP3: N: 6801790.67 E: 23379896.47, ELEV. 719.57
SET ⅝" REBAR ON SOUTHEAST SIDE OF THE BRIDGE ON THE SOUTH SIDE OF THE CREEK BANK.



Pier 1



Pier 2



Demonstration Shaft

Notes:

For Drilled Shaft and Demonstration Shaft Notes, see Design Sheet 10.

For Pier Drilled Shaft Details, see Design Sheets 8-10.

Design For 0° Skew

140'-0" × 40'-0" Continuous Concrete Slab Bridge

42'-6" End Spans — 55'-0" Interior Span

Drilled Shaft Details

STA. 57+50.00 (℄ IA 21)

Turn-in Date: April 2026

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 | Design Sheet No. 11 of 26 | FHWA No. 032601

FILE NO. 32542	ENGLISH	DESIGN TEAM Burns & McDonnell	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER V.11

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THIS SHEET IS INCLUDED TO SHOW SOIL INFORMATION.
DETAILS AND NOTES SHOWN ELSEWHERE IN THESE PLANS SHALL BE USED FOR STRUCTURE CONSTRUCTION.

GEOTECHNICAL DESIGN

LICENSED PROFESSIONAL ENGINEER
XINYI JIANG
P29458
IOWA

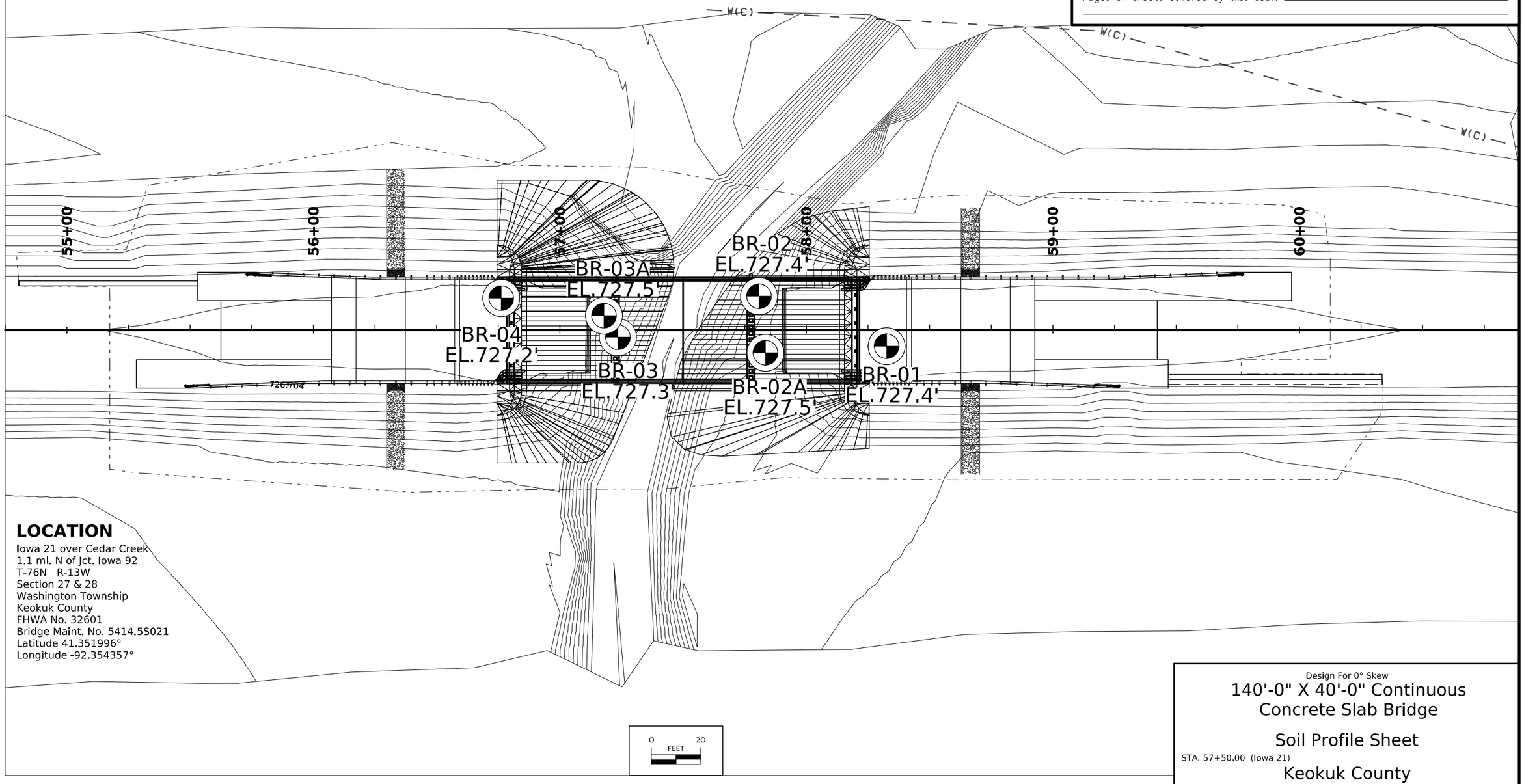
I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Signature 12-09-2025 Date

Xinyi Jiang
Printed or Typed Name

My license renewal date is December 31, 2026

Pages or sheets covered by this seal: SPS.1 & SPS.2



LOCATION

Iowa 21 over Cedar Creek
1.1 mi. N of Jct. Iowa 92
T-76N R-13W
Section 27 & 28
Washington Township
Keokuk County
FHWA No. 32601
Bridge Maint. No. 5414.5S021
Latitude 41.351996°
Longitude -92.354357°

Design For 0° Skew

140'-0" X 40'-0" Continuous Concrete Slab Bridge

Soil Profile Sheet

STA. 57+50.00 (Iowa 21)

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 Design Sheet No. 1 of 2 FHWA/Asset 32601

FILE NO. 32542	ENGLISH	DESIGN TEAM Stanley Consultants Inc./Braun Intertec	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER SPS.1

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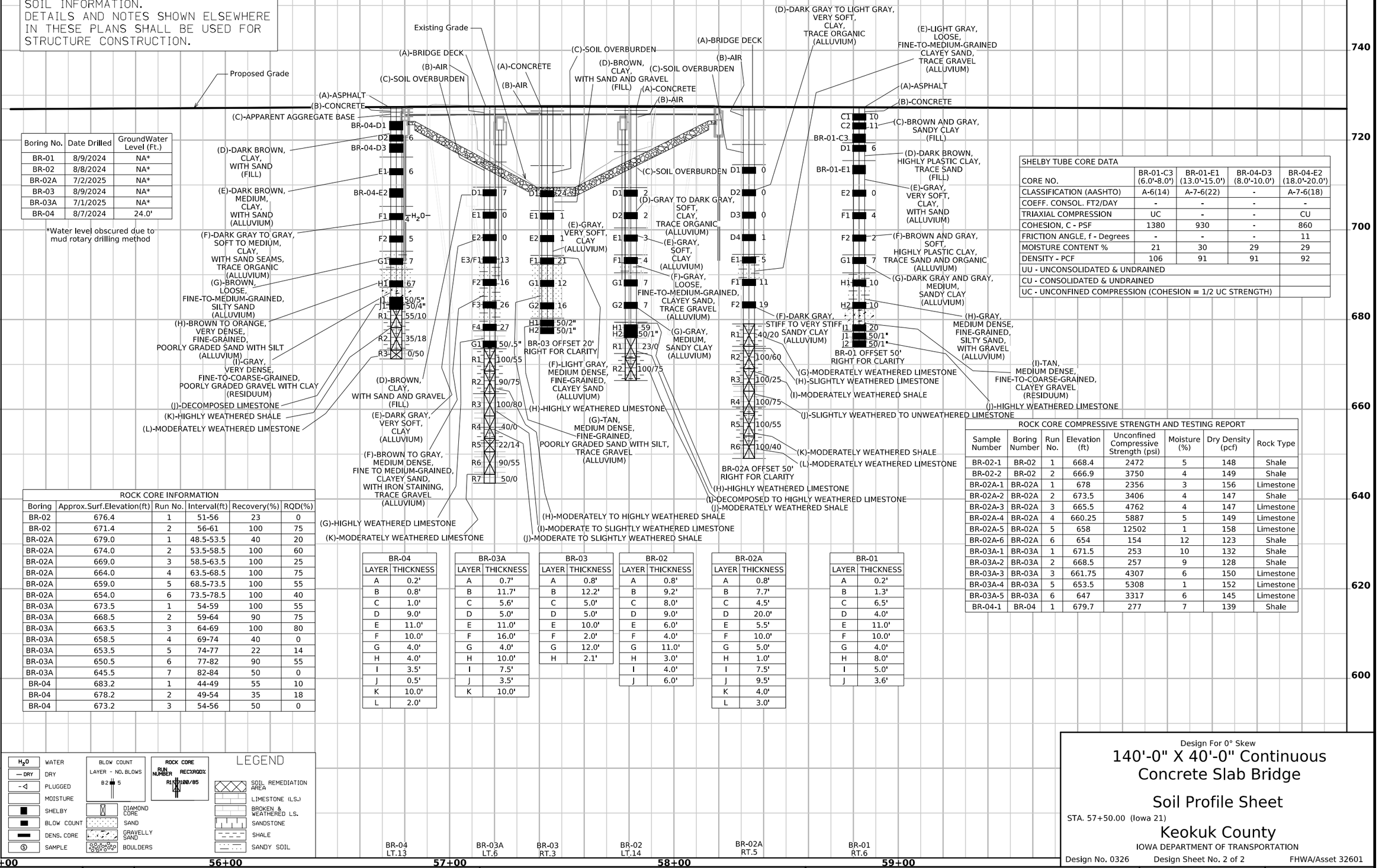
THIS SHEET IS INCLUDED TO SHOW SOIL INFORMATION.
DETAILS AND NOTES SHOWN ELSEWHERE IN THESE PLANS SHALL BE USED FOR STRUCTURE CONSTRUCTION.

Boring No.	Date Drilled	GroundWater Level (Ft.)
BR-01	8/9/2024	NA*
BR-02	8/8/2024	NA*
BR-02A	7/2/2025	NA*
BR-03	8/9/2024	NA*
BR-03A	7/1/2025	NA*
BR-04	8/7/2024	24.0'

*Water level obscured due to mud rotary drilling method



SHELBY TUBE CORE DATA				
CORE NO.	BR-01-C3 (6.0'-8.0')	BR-01-E1 (13.0'-15.0')	BR-04-D3 (8.0'-10.0')	BR-04-E2 (18.0'-20.0')
CLASSIFICATION (AASHTO)	A-6(14)	A-7-6(22)	-	A-7-6(18)
COEFF. CONSOL. FT2/DAY	-	-	-	-
TRIAXIAL COMPRESSION	UC	-	-	CU
COHESION, C - PSF	1380	930	-	860
FRICTION ANGLE, f - Degrees	-	-	-	11
MOISTURE CONTENT %	21	30	29	29
DENSITY - PCF	106	91	91	92
UU - UNCONSOLIDATED & UNDRAINED				
CU - CONSOLIDATED & UNDRAINED				
UC - UNCONFINED COMPRESSION (COHESION = 1/2 UC STRENGTH)				

ROCK CORE COMPRESSIVE STRENGTH AND TESTING REPORT

Sample Number	Boring Number	Run No.	Elevation (ft)	Unconfined Compressive Strength (psi)	Moisture (%)	Dry Density (pcf)	Rock Type
BR-02-1	BR-02	1	668.4	2472	5	148	Shale
BR-02-2	BR-02	2	666.9	3750	4	149	Shale
BR-02A-1	BR-02A	1	678	2356	3	156	Limestone
BR-02A-2	BR-02A	2	673.5	3406	4	147	Shale
BR-02A-3	BR-02A	3	665.5	4762	4	147	Limestone
BR-02A-4	BR-02A	4	660.25	5887	5	149	Limestone
BR-02A-5	BR-02A	5	658	12502	1	158	Limestone
BR-02A-6	BR-02A	6	654	154	12	123	Shale
BR-03A-1	BR-03A	1	671.5	253	10	132	Shale
BR-03A-2	BR-03A	2	668.5	257	9	128	Shale
BR-03A-3	BR-03A	3	661.75	4307	6	150	Limestone
BR-03A-4	BR-03A	5	653.5	5308	1	152	Limestone
BR-03A-5	BR-03A	6	647	3317	6	145	Limestone
BR-04-1	BR-04	1	679.7	277	7	139	Shale

ROCK CORE INFORMATION

Boring	Approx.Surf.Elevation(ft)	Run No.	Interval(ft)	Recovery(%)	RQD(%)
BR-02	676.4	1	51-56	23	0
BR-02	671.4	2	56-61	100	75
BR-02A	679.0	1	48.5-53.5	40	20
BR-02A	674.0	2	53.5-58.5	100	60
BR-02A	669.0	3	58.5-63.5	100	25
BR-02A	664.0	4	63.5-68.5	100	75
BR-02A	659.0	5	68.5-73.5	100	55
BR-02A	654.0	6	73.5-78.5	100	40
BR-03A	673.5	1	54-59	100	55
BR-03A	668.5	2	59-64	90	75
BR-03A	663.5	3	64-69	100	80
BR-03A	658.5	4	69-74	40	0
BR-03A	653.5	5	74-77	22	14
BR-03A	650.5	6	77-82	90	55
BR-03A	645.5	7	82-84	50	0
BR-04	683.2	1	44-49	55	10
BR-04	678.2	2	49-54	35	18
BR-04	673.2	3	54-56	50	0

BR-04	
LAYER	THICKNESS
A	0.2'
B	0.8'
C	1.0'
D	9.0'
E	11.0'
F	10.0'
G	4.0'
H	4.0'
I	3.5'
J	0.5'
K	10.0'
L	2.0'

BR-03A	
LAYER	THICKNESS
A	0.7'
B	11.7'
C	5.6'
D	5.0'
E	11.0'
F	16.0'
G	4.0'
H	10.0'
I	7.5'
J	3.5'
K	10.0'

BR-03	
LAYER	THICKNESS
A	0.8'
B	12.2'
C	5.0'
D	5.0'
E	10.0'
F	2.0'
G	12.0'
H	2.1'

BR-02	
LAYER	THICKNESS
A	0.8'
B	9.2'
C	8.0'
D	9.0'
E	6.0'
F	4.0'
G	11.0'
H	3.0'
I	4.0'
J	6.0'

BR-02A	
LAYER	THICKNESS
A	0.8'
B	7.7'
C	4.5'
D	20.0'
E	5.5'
F	10.0'
G	5.0'
H	1.0'
I	7.5'
J	9.5'
K	4.0'
L	3.0'

BR-01	
LAYER	THICKNESS
A	0.2'
B	1.3'
C	6.5'
D	4.0'
E	11.0'
F	10.0'
G	4.0'
H	8.0'
I	5.0'
J	3.6'

LEGEND

H_2O	WATER	SOIL REMEDIATION AREA	
— DRY	DRY	LIMESTONE (LS.)	
PLUGGED	PLUGGED	BROKEN & WEATHERED LS.	
MOISTURE	MOISTURE	SANDSTONE	
SHELBY	SHELBY	SHALE	
BLOW COUNT	BLOW COUNT (LAYER - NO. BLOWS, e.g. B2 ■ 5)	SANDY SOIL	
DENS. CORE	DIAMOND CORE		
SAMPLE	SAND		
	GRAVELLY SAND		
	BOULDERS		

ROCK CORE (RUN NUMBER, REC%RQD%, e.g. R1 100/85)

Design For 0° Skew

140'-0" X 40'-0" Continuous Concrete Slab Bridge

Soil Profile Sheet

STA. 57+50.00 (Iowa 21)

Keokuk County

IOWA DEPARTMENT OF TRANSPORTATION

Design No. 0326 | Design Sheet No. 2 of 2 | FHWA/Asset 32601

FILE NO. 32542	ENGLISH	DESIGN TEAM Stanley Consultants Inc./Braun Intertec	KEOKUK COUNTY	PROJECT NUMBER BRF-021-1(46)--38-54	SHEET NUMBER SPS.2

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