A d d e n d u m

Iowa Department of Transportation
Office of Contracts

Date of Letting: April 25, 2017
Date of Addendum: April 6, 2017

B.O.	Proposal ID	Proposal Work Type	County	Project Number	Addendum
002	82-0741-198	BRIDGE – STEEL GIRDER	SCOTT	IM-NHS-074-1(198)5--03-82	25APR002A04

Make the following changes to the PLAN:

Replace SHEETS 48, 122 and 251 with attached SHEETS 48, 122 and 251.

Note:
Removed "Aerodynamic Stability" note from the Design Criteria in the General Notes on Sheet Numbers 48, 122 & 251.

DESIGN CRITERIA

1. GENERAL

THE DESIGN CRITERIA DEFINED HEREIN PERTAIN TO THE FINAL DESIGN PHASE OF THE SUBSTRUCTURE OF THE ARCH BRIDGES, DENOTED AS SEGMENT 3, SPANNING THE MAIN CHANNEL OF THE MISSISSIPPI RIVER.

2. CLEARANCES

THE NAVIGATIONAL MINIMUM VERTICAL CLEARANCE IS 60 FEET, MEASURED FROM THE NORMAL POOL ELEVATION OF 561.0. THE MINIMUM HORIZONTAL CLEARANCE MEASURED NORMAL TO THE CHANNEL, IS 710 FT. THE INSPECTION TRAVELER WILL ENCROACH ON THE CLEARANCE ENVELOPE WHEN IN USE. APPROPRIATE WARNINGS SHALL BE POSTED ON EACH TRAVELER FOR THE TRAVELER OPERATOR.

THE MINIMUM DRAFT REQUIRED OVER THE TOP OF FOUNDATION ELEMENTS WITHIN THE NAVIGATION CHANNEL AT NORMAL POOL IS 12 FT.

3. DESIGN SPECIFICATIONS

IOWA DOT METHODS MEMOS ISSUED BY THE OFFICE OF BRIDGES AND STRUCTURES.

IOWA DOT OFFICE OF BRIDGE AND STRUCTURES, LRFD BRIDGE DESIGN MANUAL.

IOWA DOT STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, SERIES 2012 WITH GS-12001 REVISIONS.

IOWA DOT SUPPLEMENTAL SPECIFICATIONS.

IOWA DOT MATERIALS INSTRUCTIONAL MEMORANDUMS.

AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, FIFTH EDITION, 2010.

AASHTO/AWS D1.5M/D1.5:2010, BRIDGE WELDING CODE.

AASHTO LRFD GUIDE SPECIFICATIONS FOR THE DESIGN OF PEDESTRIAN BRIDGES, 2009.

POST-TENSIONING INSTITUTE GUIDE SPECIFICATION-RECOMMENDATIONS FOR STAY CABLE DESIGN, TESTING AND INSTALLATION, FIFTH EDITION, 2007.

EURO - INTERNATIONAL COMMITTEE FOR CONCRETE AND THE INTERNATIONAL FEDERATION FOR PRESTRESSING "(CEB-FIP) MODEL CODE FOR CONCRETE STRUCTURES", 3RD EDITION, 1990.

ACI BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE AND COMMENTARY, ACI 318-08, AMERICAN CONCRETE INSTITUTE, 2008.

AASHTO GUIDE SPECIFICATIONS AND COMMENTARY FOR VESSEL COLLISION DESIGN OF HIGHWAY BRIDGES, 2009 WITH 2010 INTERIM. METHOD 1 IS UTILIZED TO DETERMINE DESIGN LOADS. SOME MODIFICATIONS WERE NECESSARY; SEE THE VESSEL COLLISION LOAD REPORT.

FHWA HYDRAULIC ENGINEERING CIRCULAR (HEC-18) "EVALUATING SCOUR AT BRIDGES", FOURTH EDITION, 2001 WITH ERRATA.

FHWA HYDRAULIC ENGINEERING CIRCULAR (HEC-20 "STREAM STABILITY AT HIGHWAY STRUCTURES", THIRD EDITION, 2001 WITH ERRATA.

AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, MARCH 9, 2005.

4. DESIGN METHOD

THE LOAD AND RESISTANCE FACTOR DESIGN METHOD (LRFD).

5. DESIGN LIFE

THE BRIDGE DESIGN LIFE IS 100 YEARS.

6. DESIGN UNITS

ALL UNITS ARE U.S. CUSTOMARY.

7. DESIGN LOADS

I. DEAD LOADS

UNIT WEIGHTS ARE IN ACCORDANCE WITH AASHTO LRFD. NO ALLOWANCE HAS BEEN PROVIDED FOR A FUTURE WEARING SURFACE ON THE ARCH VEHICLE SPANS. ORIGINAL WEARING SURFACE IS CONSIDERED A DC LOADING APPLIED TO LONG TERM COMPOSITE SECTIONS WHERE APPLICABLE. AN ALLOWANCE OF 20 PSF IS INCLUDED FOR A FUTURE WEARING SURFACE ON THE BIKE TRAIL AS A DW LOADING. A 250 LBS/FT ALLOWANCE HAS BEEN PROVIDED FOR ROADWAY LIGHTING AND UTILITIES, AS WELL AS A 50 LBS/FT ALLOWANCE FOR A MAINTENANCE WATER LINE.

II. VEHICULAR LIVE LOADS

IN ACCORDANCE WITH AASHTO LRFD EXCEPT AS NOTED HEREIN.

III. BIKE TRAIL / OVERLOOK LIVE LOADS

WHEN ONLY PEDESTRIAN LOADS ARE PRESENT, 90 PSF ON THE TRAIL, AS PER THE AASHTO LRFD GUIDE SPECIFICATIONS FOR THE DESIGN OF PEDESTRIAN BRIDGES. UNDER THIS LOADING, WHEN PEDESTRIAN LOAD IS PRESENT WITH VEHICULAR LIVE LOAD IN THE VEHICLE LANES, 75 PSF ON THE PATH IS USED.

IV. WIND LOADS

DESIGN WIND SPEED:

APPLICATION	RETURN PERIOD (YEARS)	WIND SPEED (MPH)
CONSTRUCTION	25	80.5
FINAL DESIGN	100	91.7
CONSTRUCTION STABILITY	1000	116.3
FINAL STABILITY	10000	138.7

THE DESIGN WIND SPEEDS WERE BASE ON A SITE-SPECIFIC WIND STUDY. DRAG COEFFICIENTS WERE BASED ON WIND TUNNEL STUDIES. THE BRIDGE IS DESIGNED FOR EITHER THE STATIC WIND FORCE OR THE DYNAMIC BUFFETING FORCE, WHICHEVER IS GREATER. FOR VIBRATIONS CAUSED BY VORTEX SHEDDING, VERTICAL ACCELERATIONS ARE LESS THAN 5% G FOR WIND SPEEDS UP TO 30 MPH AND LESS THAN 10% G FOR WIND SPEEDS BETWEEN 30 MPH AND 50 MPH. FOR WIND SPEEDS OVER 50 MPH IT IS ASSUMED THAT WIND DISCOMFORT EXCEEDS MOTION DISCOMFORT. FOR MORE INFORMATION SEE THE WEST WIND LABORATORY, INC. WIND STUDY FINAL REPORT.

V. NOT USED

VI. SNOW AND ICE LOADS

ICE ACCRETION AND SNOW LOADS ON THE SUPERSTRUCTURE ARE NOT CONSIDERED.

VII. SEISMIC LOADS

THE SEISMIC LOADS ARE AS SPECIFIED IN AASHTO LRFD, USING AN ELASTIC MULTI-MODAL SPECTRAL ANALYSIS OF THE BRIDGE, WITH THE EXCEPTION THAT THE ACCELERATIONS ARE BASED ON THE USGS 2008 VALUES FOR A RETURN PERIOD OF 2,500 YEARS. SEAT WIDTHS AT EXPANSION BEARINGS SATISFY THE REQUIREMENTS OF AASHTO LRFD ARTICLE 4.7.4.4.

VIII. VESSEL COLLISION LOADS

THE VESSEL COLLISION LOAD USED FOR THE DESIGN OF THE PIERS OF THE ARCH BRIDGE IS 5,610 KIPS. FOR MORE INFORMATION, SEE THE MEMO ENTITLED: PRELIMINARY VESSEL COLLISION LOADS FOR THE MISSISSIPPI RIVER BRIDGE BETWEEN BETTENDORF, IOWA AND MOLINE, ILLINOIS.

IX. THERMAL LOADS

THE CONSTRUCTION TEMPERATURE IS ASSUMED TO BE 50 DEGREES FAHRENHEIT, WITH A MAXIMUM RISE OF 75 AND A MAXIMUM FALL OF 75 DEGREES FAHRENHEIT. THERMAL GRADIENT LOADS ARE AS SPECIFIED IN AASHTO LRFD.

X. FOUNDATION SETTLEMENT LOADS

LOADS DUE TO A 1" LONGITUDINAL FOUNDATION MOVEMENT ARE INCLUDED IN ALL APPLICABLE LOAD CASES.

8. LOAD AND RESISTANCE FACTORS

LOAD MODIFIERS

DUCTILITY - 1.0 FOR ALL ELEMENTS.
REDUNDANCY - FOR THE ARCH RIB, THE ARCH RIB BRACING, THE WIND TONGUE AND THE END SPANS OF THE STIFFENING GIRDER, THE REDUNDANCY FACTOR IS TAKEN AS 1.05. THE REDUNDANCY FACTOR IS TAKEN AS 1.0 FOR ALL OTHER ELEMENTS.
OPERATIONAL IMPORTANCE - FOR THE DESIGN OF THE ARCH RIB, ARCH RIB BRACING, WIND TONGUE, STIFFENING GIRDER, FLOORBEAMS, AND HANGERS, THE IMPORTANCE FACTOR IS TAKEN AS 1.05. THE OPERATIONAL IMPORTANCE FACTOR IS TAKEN AS 1.0 FOR ALL OTHER ELEMENTS.

LOAD FACTORS

FOR ALL LOAD CASES, THE LOAD FACTORS ARE AS SPECIFIED IN AASHTO LRFD, EXCEPT AS NOTED HEREIN.

RESISTANCE FACTORS

THE RESISTANCE FACTORS ARE AS SPECIFIED IN AASHTO LRFD.

9. DESIGN LOAD COMBINATIONS

AS SPECIFIED IN AASHTO LRFD, WITH THE MODIFICATIONS LISTED HEREIN.

WIND BUFFETING

LOADS RESULTING FROM A WIND BUFFETING ANALYSIS WERE USED IN THE AASHTO LRFD STRENGTH III LOAD CASE WITH THE EXCEPTION THAT A LOAD FACTOR OF 1.25 WAS USED IN PLACE OF THE 1.40 FACTOR. THIS IS TO ACCOUNT FOR THE FACT THAT THE WIND SPEEDS USED IN THE ANALYSIS WERE DEVELOPED FROM A SITE-SPECIFIC ANALYSIS, THAT THE ACTUAL DYNAMIC BEHAVIOR OF THE STRUCTURE WAS INCLUDED, AND THAT A REALISTIC ESTIMATE OF THE TURBULENCE WAS ALSO MADE.

10. STATIC ANALYSIS NONLINEAR EFFECTS

THE ANALYSIS OF THE ARCH RIBS INCLUDES THE EFFECTS OF NON-LINEARITY ARISING FROM THE DISPLACEMENTS OF THE ARCH RIB DUE TO THE COMBINED EFFECTS OF AXIAL FORCES, BENDING MOMENTS AND TEMPERATURE VARIATIONS.

11. STABILITY ANALYSIS

THE METHOD USED TO ACCOUNT FOR THE EFFECTS OF INSTABILITY ON THE DESIGN OF THE ARCH BRIDGES IS THE EFFECTIVE LENGTH METHOD DESCRIBED IN THE COMMENTARY TO SECTION C OF THE AISC "SPECIFICATION FOR STRUCTURAL STEEL BUILDING, MARCH 9, 2005." BASED ON A NONLINEAR ANALYSIS THE EFFECTIVE LENGTH FACTOR FOR BUCKLING, KL/R, IS 90 IN-PLANE AND 100 OUT-OF-PLANE.

12. NOT USED

13. MATERIALS

SEE GENERAL NOTES SHEET.

14. PAINT

EMBEDDED PLATES SHALL BE PAINTED WITH A PRIME COAT AND FINISH COAT OF SURFACE-TOLERANT PAINT SUCH AS CARBOGUARD 890, INTERGUARD 345, OR APPROVED EQUAL. TARGETED DRY FILM THICKNESS SHALL BE 4 TO 7 MILS. COLOR SHALL MATCH FEDERAL STANDARD NO. 595C COLOR NUMBER 27925 SATIN WHITE. THE EMBEDDED PLATES SHALL BE GIVEN A NEAR WHITE BLAST CLEANING IN ACCORDANCE WITH SSPC-SP10 PRIOR TO PAINTING.

15. WIND TONGUE

TWO BEARINGS TO REACT LATERAL LOADS ARE PROVIDED FOR EACH BRIDGE, LOCATED AT THE MIDDLE OF THE END FLOORBEAMS.

16. BEARINGS

STIFFENING GIRDER: HIGH LOAD MULTI-ROTATIONAL (HLMR) BEARINGS WITH PTFE SLIDING SURFACES ARE PROVIDED AT THE EXPANSION END OF EACH STIFFENING GIRDER CARRYING VERTICAL LOADS ONLY. PIN BEARINGS ARE PROVIDED AT THE FIXED END OF EACH STIFFENER GIRDER, PROVIDING VERTICAL AND LONGITUDINAL RESTRAINT.

BIKE TRAIL: ELASTOMERIC BEARINGS WITH A PTFE SLIDING SURFACE ARE PROVIDED AT BOTH ENDS OF THE BIKE TRAIL.

17. JOINTS

A MODULAR EXPANSION JOINT IS PROVIDED AT THE EXPANSION END OF THE BRIDGE. A STEEL FINGER JOINT IS PROVIDED AT THE FIXED END OF THE BRIDGE TO ACCOMMODATE APPROACH SPAN EXPANSION AND GIRDER ROTATIONS. THE JOINTS SHALL BE SET AT CONSTRUCTION SUCH THAT THEY WILL BE CENTERED AT 50 DEGREES FAHRENHEIT.

NOTES:

FOR GENERAL NOTES, SEE DESIGN SHEET 5.

FOR ADDITIONAL DESIGN CRITERIA SEE DESIGNS 617 AND 717.

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Chicago, Illinois 60601
312-565-0450 Job No. 10061

SUBSTRUCTURE DESIGN FOR 0° SKEW

DUAL 795'-0 x 72' STEEL ARCH BRIDGE

DESIGN CRITERIA
ARCH SUBSTRUCTURE

STA. 6770+98.50, ℄ PROPOSED I-74 DECEMBER 2016

SCOTT & ROCK ISLAND COUNTIES

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 4 OF 74 FILE NO. 30253 DESIGN NO. 817

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CHANGED BY ADDENDA 4/5/2017

DESIGN CRITERIA (CONTINUED)

AMPLIFICATION FACTOR
THE AMPLIFICATION FACTOR WAS FOUND BY DIVIDING THE MOMENT VALUES OBTAINED FROM A NONLINEAR FINITE ELEMENT ANALYSIS BY THE VALUES OBTAINED FROM A LINEAR FINITE ELEMENT ANALYSIS AT REPRESENTATIVE LOCATIONS UNDER THE STRENGTH I AND SERVICE I LOAD CASES. A CONSERVATIVE AMPLIFICATION FACTOR OF 1.25 WHICH ENVELOPED THE VALUES FOUND WAS USED ON ALL ARCH MEMBER MOMENTS AND SHEARS FOR ALL LOAD CASES.

10. DESIGN LOAD COMBINATIONS

AS SPECIFIED IN AASHTO LRFD, WITH THE MODIFICATIONS LISTED HEREIN.

LIVE LOAD DEFLECTIONS
THE LIVE LOAD DEFLECTIONS OTHER THAN BIKE TRAIL DEFLECTIONS ARE LIMITED TO THE OPTIONAL AASHTO LRFD CRITERIA FOR DEFLECTIONS, ARTICLE 2.5.2.6.2.

FATIGUE DESIGN
FATIGUE DESIGN IS IN ACCORDANCE WITH AASHTO LRFD, WITH THE EXCEPTIONS LISTED HEREIN. DESIGN IS BASED ON INFINITE LIFE CRITERIA, UNLESS IT IS UNECONOMICAL TO PROVIDE FOR INFINITE LIFE IN WHICH CASE, A FINITE LIFE OF 100 YEARS IS USED, BASED ON AN ADTT = 3219. THE ADTT IS BASED ON AN AVERAGE CALCULATED FROM THE TRAFFIC ESTIMATES LISTED ON THE SITUATION PLAN.

WIND BUFFETING
LOADS RESULTING FROM A WIND BUFFETING ANALYSIS WERE USED IN THE AASHTO LRFD STRENGTH III LOAD CASE WITH THE EXCEPTION THAT A LOAD FACTOR OF 1.25 WAS USED IN PLACE OF THE 1.40 FACTOR. THIS IS TO ACCOUNT FOR THE FACT THAT THE WIND SPEEDS USED IN THE ANALYSIS WERE DEVELOPED FROM A SITE-SPECIFIC ANALYSIS, THAT THE ACTUAL DYNAMIC BEHAVIOR OF THE STRUCTURE WAS INCLUDED, AND THAT A REALISTIC ESTIMATE OF THE TURBULENCE WAS ALSO MADE.

11. STATIC ANALYSIS NONLINEAR EFFECTS

THE ANALYSIS OF THE ARCH RIBS INCLUDES THE EFFECTS OF NON-LINEARITY ARISING FROM THE DISPLACEMENTS OF THE ARCH RIB DUE TO THE COMBINED EFFECTS OF AXIAL FORCES, BENDING MOMENTS AND TEMPERATURE VARIATIONS.

12. STABILITY ANALYSIS

THE METHOD USED TO ACCOUNT FOR THE EFFECTS OF INSTABILITY ON THE DESIGN OF THE ARCH BRIDGES IS THE EFFECTIVE LENGTH METHOD DESCRIBED IN THE COMMENTARY TO SECTION C OF THE AISC "SPECIFICATION FOR STRUCTURAL STEEL BUILDING, MARCH 9, 2005." BASED ON A NONLINEAR ANALYSIS THE EFFECTIVE LENGTH FACTOR FOR BUCKLING, KL/R, IS 90 IN-PLANE AND 100 OUT-OF-PLANE.

13. AERODYNAMIC STABILITY - DELETED

14. HANGERS AND SOCKETS

HANGERS ARE DESIGNED BASED ON THE FOLLOWING:
STRENGTH LOAD CASES - FULL FACTORED LOADS AND A RESISTANCE FACTOR OF 0.65 ON MINIMUM BREAKING STRENGTH AS SPECIFIED IN THE PTI RECOMMENDATIONS FOR STAY CABLE DESIGN, TESTING AND INSTALLATION, FIFTH EDITION, 2007.
SERVICE LOAD CASE - MINIMUM FACTOR OF SAFETY OF 3.0 ON MINIMUM BREAKING STRENGTH FOR A LOAD CONSISTING OF 1.0*DL+1.0*(LL+I)+1.0*TU.
SERVICE LOAD II - FACTORED LOAD LESS THAN 90% OF YIELD STRENGTH. YIELD STRENGTH TAKEN AS 160 KSI. FATIGUE STRESS RANGE - 16 KSI. AN ADDITIONAL 1.40 LOAD FACTOR IS ALSO APPLIED TO THE FATIGUE LOADING FOR THE HANGERS ONLY. BASED ON THE PTI RECOMMENDATIONS FOR STAY CABLE DESIGN, TESTING AND INSTALLATION, FIFTH EDITION, OCTOBER 2007.

15. MATERIALS

STRUCTURAL STEEL
AASHTO M270 GRADE 50 (GR. 50)
AASHTO M270 GRADE 50W (GR. 50W)
AASHTO M270 GRADE HPS 70W (HPS 70W)

HIGH STRENGTH BOLTS
AASHTO M164 (ASTM A325)

SHEAR STUDS
AASHTO M169 (ASTM A108)

PINS
ASTM A668 CLASS F GRADE 50

STRUCTURAL CONCRETE

	28 DAY COMPRESSIVE STRENGTH	
PARAPETS	f'c= 3.5 KSI	
DECK CONCRETE	f'c= 5.0 KSI	STRUCTURAL CONCRETE 4500 PSI (31 MPA) OR GREATER
BRIDGE DECK SURFACING		HIGH PERFORMANCE CONCRETE CLASS HPC-O OR LOW SLUMP CLASS O PCC

HANGERS

ASTM A586 STRUCTURAL STRAND WITH CLASS C COATING AND ZINC POURED SOCKETS

SOCKETS

OPEN AND CLOSED BRIDGE STRAND SOCKETS CONFORMING TO ASTM A148 STEEL GRADE 105/85

MAIN BEARING ANCHOR BOLTS

ASTM A354 GRADE BD ANCHOR BOLTS MINIMUM TENSILE STRENGTH 150 KSI
ASTM A563 GRADE DH HEAVY HEX NUTS

POST-TENSIONING RODS
SEE SPECIAL PROVISIONS FOR HIGH STRENGTH, STAINLESS STEEL BARS FOR POST-TENSIONED CONCRETE

BARRIER RAIL

PLATES ASTM A709 OR A529 GRADE 50
ELLIPTICAL TUBE ASTM A53E OR S GRADE B OR API-5LX52

BARRIER RAIL AND BEARING PLATE ANCHOR BOLTS

ASTM A193 GRADE B7 DRILLED ANCHOR BOLTS
ASTM F1554 GRADE 105 CAST-IN-PLACE ANCHOR BOLTS
ASTM A563-DH NUTS
ASTM F-436 WASHERS

BARRIER RAIL ANCHOR BOLTS, NUTS AND WASHERS GALVANIZED IN ACCORDANCE WITH ASTM F2329

CABLE HANDRAILS
ASTM A603 STRUCTURAL WIRE ROPE

REINFORCING STEEL

ASTM A955 GRADE 75 STAINLESS STEEL

PAINT

EXTERIOR SURFACES - FLUOROPOLYMER PAINT SYSTEM
INTERIOR SURFACES - SURFACE TOLERANT PAINT SYSTEM
FOR MORE INFORMATION - SEE SPECIAL PROVISIONS FOR FLUOROPOLYMER PAINT FOR STRUCTURAL STEEL

16. BRIDGE DECK

THE BRIDGE DECK IS TWO-COURSE, WITH AN 8 INCH STRUCTURAL COURSE AND A 2 INCH SURFACING COURSE. THE CLEAR COVER TO THE REINFORCEMENT IN THE TOP MAT OF THE STRUCTURAL COURSE IS 2.0 INCHES (4.0 INCHES TOTAL COVER). THE 8 INCH STRUCTURAL COURSE IS COMPOSITE WITH THE STRINGERS, FLOORBEAMS, AND STIFFENING GIRDERS.

17. ROADWAY PARAPETS

THE PARAPETS ON THE MAIN BRIDGE ROADWAY ARE MODIFIED PA-HT BRIDGE BARRIERS MEETING THE AASHTO LRFD ARTICLE 13.7.2 TL-5 SECTION CRITERIA.

18. BOLTED CONNECTIONS

BOLTED CONNECTIONS ARE DESIGNED AS SLIP-CRITICAL JOINTS WITH ALL FAYING SURFACES HAVING A CLASS B SLIP COEFFICIENT. THREADS ARE ASSUMED TO BE EXCLUDED FROM SHEAR PLANES. ALL FORCES IN ARCH RIB BOLTED SPLICES WILL BE CARRIED BY THE BOLTS, I.E. NO CONTACT BETWEEN RIB PLATE ENDS IS ASSUMED. ALL HOLED ARE ASSUMED DRILLED FULL OR SUBPUNCHED AND REAMED TO SIZE.

19. FRACTURE CRITICAL MEMBERS (FCM)

THE WIND TONGUES, THE ARCH RIBS, THE BRACING, THE FLOORBEAMS BETWEEN THE STIFFENING GIRDERS, AND END SPANS OF THE STIFFENING GIRDERS ARE DESIGNATED FRACTURE CRITICAL MEMBERS (FCM). IN ADDITION TO THE CVN AND FABRICATION REQUIREMENTS FOR FRACTURE CRITICAL MEMBERS, HPS GRADE 70W STEEL IS USED FOR ALL FLOORBEAM BOTTOM FLANGES BETWEEN STIFFENING GIRDERS, AND THE ENTIRE GIRDER OF ALL STIFFENING GIRDERS FROM EACH END TO THE THIRD HANGER. THE ADDITIONAL STRENGTH OF THE GRADE 70 FLANGE OVER A GRADE 50 MATERIAL IS NOT CONSIDERED IN THE CAPACITY CALCULATIONS FOR THE FLOORBEAMS.

20. DECK REPLACEABILITY

THE DECK MEETS THE FOLLOWING REQUIREMENTS:

A. 2.0" WEARING SURFACE IS REPLACEABLE WITH PROVEN CONSTRUCTION TECHNIQUES.

B. THE DECK IS ABLE TO ACCOMMODATE LOCAL REPAIR OR REPLACEMENT.

C. PROVISIONS ARE SUCH THAT REPLACEMENT OF THE ENTIRE DECK CAN BE PERFORMED USING PRACTICAL METHODS WITH GOAL OF REPLACING THE DECK IN ONE DIRECTION IN ONE YEAR.

21 WIND TONGUE

TWO BEARINGS TO REACT LATERAL LOADS ARE PROVIDED FOR EACH BRIDGE, LOCATED AT THE MIDDLE OF THE END FLOORBEAMS.

22. BEARINGS

STIFFENING GIRDER

HIGH LOAD MULTI-ROTATIONAL (HLMR) BEARINGS WITH PTFE SLIDING SURFACES ARE PROVIDED AT THE EXPANSION END OF EACH STIFFENING GIRDER CARRYING VERTICAL LOADS ONLY. PIN BEARINGS ARE PROVIDED AT THE FIXED END OF EACH STIFFENER GIRDER, PROVIDING VERTICAL AND LONGITUDINAL RESTRAINT.

BIKE TRAIL

ELASTOMERIC BEARINGS WITH A PTFE SLIDING SURFACE ARE PROVIDED AT BOTH ENDS OF THE BIKE TRAIL.

23. JOINTS

A MODULAR EXPANSION JOINT IS PROVIDED AT THE EXPANSION END OF THE BRIDGE. A STEEL FINGER JOINT IS PROVIDED AT THE FIXED END OF THE BRIDGE TO ACCOMMODATE APPROACH SPAN EXPANSION AND GIRDER ROTATIONS. THE JOINTS SHALL BE SET AT CONSTRUCTION SUCH THAT THEY WILL BE CENTERED AT 50 DEGREES FAHRENHEIT.

24. COMPONENT REPLACEMENT

PROVISIONS HAVE BEEN MADE TO ALLOW REPLACEMENT OF COMPONENTS SUCH AS BEARINGS, JOINTS AND HANGERS. AS THE BRIDGE IS DESIGNED FOR REDUNDANCY IN THE HANGERS, SINGLE HANGER REPLACEMENT WILL BE PERFORMABLE ONE HANGER AT A TIME UNDER NORMAL TRAFFIC. FOR BEARING REPLACEMENT, SUFFICIENT BEARING AREA TO LOCATE JACKS IS PROVIDED.

25. BIKE TRAIL/OVERLOOK RAILINGS

APPROVED AESTHETIC BIKE TRAIL/OVERLOOK RAILINGS ARE DESIGNED PER THE REQUIREMENTS OF AASHTO LRFD ARTICLES 13.8, 13.9, AND 13.10.

NOTES:

FOR GENERAL NOTES, SEE DESIGN SHEETS 6 AND 7.

SUPERSTRUCTURE DESIGN FOR 0° SKEW

795'-0 x 72'-0 STEEL ARCH BRIDGE

DESIGN CRITERIA

WESTBOUND ARCH SUPERSTRUCTURE

STATION: 6770+98.50 52' RIGHT - CL I-74 DECEMBER 2016

SCOTT & ROCK ISLAND COUNTIES

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 4 OF 129 FILE NO. 30253 DESIGN NO. 617

DESIGN CRITERIA (CONTINUED)

AMPLIFICATION FACTOR
THE AMPLIFICATION FACTOR WAS FOUND BY DIVIDING THE MOMENT VALUES OBTAINED FROM A NONLINEAR FINITE ELEMENT ANALYSIS BY THE VALUES OBTAINED FROM A LINEAR FINITE ELEMENT ANALYSIS AT REPRESENTATIVE LOCATIONS UNDER THE STRENGTH I AND SERVICE I LOAD CASES. A CONSERVATIVE AMPLIFICATION FACTOR OF 1.25 WHICH ENVELOPED THE VALUES FOUND WAS USED ON ALL ARCH MEMBER MOMENTS AND SHEARS FOR ALL LOAD CASES.

10. DESIGN LOAD COMBINATIONS

AS SPECIFIED IN AASHTO LRFD, WITH THE MODIFICATIONS LISTED HEREIN.

LIVE LOAD DEFLECTIONS
THE LIVE LOAD DEFLECTIONS OTHER THAN BIKE TRAIL DEFLECTIONS ARE LIMITED TO THE OPTIONAL AASHTO LRFD CRITERIA FOR DEFLECTIONS, ARTICLE 2.5.2.6.2.

FATIGUE DESIGN
FATIGUE DESIGN IS IN ACCORDANCE WITH AASHTO LRFD, WITH THE EXCEPTIONS LISTED HEREIN. DESIGN IS BASED ON INFINITE LIFE CRITERIA, UNLESS IT IS UNECONOMICAL TO PROVIDE FOR INFINITE LIFE IN WHICH CASE, A FINITE LIFE OF 100 YEARS IS USED, BASED ON AN ADTT = 3219. THE ADTT IS BASED ON AN AVERAGE CALCULATED FROM THE TRAFFIC ESTIMATES LISTED ON THE SITUATION PLAN.

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LOADS RESULTING FROM A WIND BUFFETING ANALYSIS WERE USED IN THE AASHTO LRFD STRENGTH III LOAD CASE WITH THE EXCEPTION THAT A LOAD FACTOR OF 1.25 WAS USED IN PLACE OF THE 1.40 FACTOR. THIS IS TO ACCOUNT FOR THE FACT THAT THE WIND SPEEDS USED IN THE ANALYSIS WERE DEVELOPED FROM A SITE-SPECIFIC ANALYSIS, THAT THE ACTUAL DYNAMIC BEHAVIOR OF THE STRUCTURE WAS INCLUDED, AND THAT A REALISTIC ESTIMATE OF THE TURBULENCE WAS ALSO MADE.

11. STATIC ANALYSIS NONLINEAR EFFECTS

THE ANALYSIS OF THE ARCH RIBS INCLUDES THE EFFECTS OF NON-LINEARITY ARISING FROM THE DISPLACEMENTS OF THE ARCH RIB DUE TO THE COMBINED EFFECTS OF AXIAL FORCES, BENDING MOMENTS AND TEMPERATURE VARIATIONS.

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13. AERODYNAMIC STABILITY - DELETED

14. HANGERS AND SOCKETS

HANGERS ARE DESIGNED BASED ON THE FOLLOWING:
STRENGTH LOAD CASES - FULL FACTORED LOADS AND A RESISTANCE FACTOR OF 0.65 ON MINIMUM BREAKING STRENGTH AS SPECIFIED IN THE PTI RECOMMENDATIONS FOR STAY CABLE DESIGN, TESTING AND INSTALLATION, FIFTH EDITION, 2007.
SERVICE LOAD CASE - MINIMUM FACTOR OF SAFETY OF 3.0 ON MINIMUM BREAKING STRENGTH FOR A LOAD CONSISTING OF 1.0*DL+1.0*(LL+I)+1.0*TU.
SERVICE LOAD II - FACTORED LOAD LESS THAN 90% OF YIELD STRENGTH. YIELD STRENGTH TAKEN AS 160 KSI. FATIGUE STRESS RANGE - 16 KSI. AN ADDITIONAL 1.40 LOAD FACTOR IS ALSO APPLIED TO THE FATIGUE LOADING FOR THE HANGERS ONLY. BASED ON THE PTI RECOMMENDATIONS FOR STAY CABLE DESIGN, TESTING AND INSTALLATION, FIFTH EDITION, OCTOBER 2007.

15. MATERIALS

STRUCTURAL STEEL
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AASHTO M270 GRADE 50W (GR. 50W)
AASHTO M270 GRADE HPS 70W (HPS 70W)

HIGH STRENGTH BOLTS
AASHTO M164 (ASTM A325)

SHEAR STUDS
AASHTO M169 (ASTM A108)

PINS
ASTM A668 CLASS F GRADE 50

STRUCTURAL CONCRETE

	28 DAY COMPRESSIVE STRENGTH	
PARAPETS	f'c= 3.5 KSI	
DECK CONCRETE	f'c= 5.0 KSI	STRUCTURAL CONCRETE 4500 PSI OR GREATER
BRIDGE DECK SURFACING		HIGH PERFORMANCE CONCRETE CLASS HPC-O OR LOW SLUMP CLASS O PCC

HANGERS

ASTM A586 STRUCTURAL STRAND WITH CLASS C COATING AND ZINC POURED SOCKETS

SOCKETS

OPEN AND CLOSED BRIDGE STRAND SOCKETS CONFORMING TO ASTM A148 STEEL GRADE 105/85

MAIN BEARING ANCHOR BOLTS

ASTM A354 GRADE BD ANCHOR BOLTS MINIMUM TENSILE STRENGTH 150 KSI
ASTM A563 GRADE DH HEAVY HEX NUTS

POST-TENSIONING RODS
SEE SPECIAL PROVISIONS FOR HIGH STRENGTH, STAINLESS STEEL BARS FOR POST-TENSIONED CONCRETE

BARRIER RAIL

PLATES ASTM A709 OR A529 GRADE 50
ELLIPTICAL TUBE ASTM A53E OR S GRADE B OR API-5LX52

BARRIER RAIL AND BEARING PLATE ANCHOR BOLTS

ASTM A193 GRADE B7 DRILLED ANCHOR BOLTS
ASTM F1554 GRADE 105 CAST-IN-PLACE ANCHOR BOLTS
ASTM A563-DH NUTS
ASTM F-436 WASHERS

BARRIER RAIL ANCHOR BOLTS, NUTS AND WASHERS GALVANIZED IN ACCORDANCE WITH ASTM F2329

CABLE HANDRAILS
ASTM A603 STRUCTURAL WIRE ROPE

REINFORCING STEEL

ASTM A955 GRADE 75 STAINLESS STEEL

PAINT

EXTERIOR SURFACES - FLUOROPOLYMER PAINT SYSTEM
INTERIOR SURFACES - SURFACE TOLERANT PAINT SYSTEM
FOR MORE INFORMATION - SEE SPECIAL PROVISIONS FOR FLUOROPOLYMER PAINT FOR STRUCTURAL STEEL

16. BRIDGE DECK

THE BRIDGE DECK IS TWO-COURSE, WITH AN 8 INCH STRUCTURAL COURSE AND A 2 INCH SURFACING COURSE. THE CLEAR COVER TO THE REINFORCEMENT IN THE TOP MAT OF THE STRUCTURAL COURSE IS 2.0 INCHES (4.0 INCHES TOTAL COVER). THE 8 INCH STRUCTURAL COURSE IS COMPOSITE WITH THE STRINGERS, FLOORBEAMS, AND STIFFENING GIRDERS.

17. ROADWAY PARAPETS

THE PARAPETS ON THE MAIN BRIDGE ROADWAY ARE MODIFIED PA-HT BRIDGE BARRIERS MEETING THE AASHTO LRFD ARTICLE 13.7.2 TL-5 SECTION CRITERIA.

18. BOLTED CONNECTIONS

BOLTED CONNECTIONS ARE DESIGNED AS SLIP-CRITICAL JOINTS WITH ALL FAYING SURFACES HAVING A CLASS B SLIP COEFFICIENT. THREADS ARE ASSUMED TO BE EXCLUDED FROM SHEAR PLANES. ALL FORCES IN ARCH RIB BOLTED SPLICES WILL BE CARRIED BY THE BOLTS, I.E. NO CONTACT BETWEEN RIB PLATE ENDS IS ASSUMED. ALL HOLED ARE ASSUMED DRILLED FULL OR SUBPUNCHED AND REAMED TO SIZE.

19. FRACTURE CRITICAL MEMBERS (FCM)

THE WIND TONGUES, THE ARCH RIBS, THE BRACING, THE FLOORBEAMS BETWEEN THE STIFFENING GIRDERS, AND END SPANS OF THE STIFFENING GIRDERS ARE DESIGNATED FRACTURE CRITICAL MEMBERS (FCM). IN ADDITION TO THE CVN AND FABRICATION REQUIREMENTS FOR FRACTURE CRITICAL MEMBERS, HPS GRADE 70W STEEL IS USED FOR ALL FLOORBEAM BOTTOM FLANGES BETWEEN STIFFENING GIRDERS, AND THE ENTIRE GIRDER OF ALL STIFFENING GIRDERS FROM EACH END TO THE THIRD HANGER. THE ADDITIONAL STRENGTH OF THE GRADE 70 FLANGE OVER A GRADE 50 MATERIAL IS NOT CONSIDERED IN THE CAPACITY CALCULATIONS FOR THE FLOORBEAMS.

20. DECK REPLACEABILITY

THE DECK MEETS THE FOLLOWING REQUIREMENTS:

A. 2.0" WEARING SURFACE IS REPLACEABLE WITH PROVEN CONSTRUCTION TECHNIQUES.

B. THE DECK IS ABLE TO ACCOMMODATE LOCAL REPAIR OR REPLACEMENT.

C. PROVISIONS ARE SUCH THAT REPLACEMENT OF THE ENTIRE DECK CAN BE PERFORMED USING PRACTICAL METHODS WITH GOAL OF REPLACING THE DECK IN ONE DIRECTION IN ONE YEAR.

21 WIND TONGUE

TWO BEARINGS TO REACT LATERAL LOADS ARE PROVIDED FOR EACH BRIDGE, LOCATED AT THE MIDDLE OF THE END FLOORBEAMS.

22. BEARINGS

STIFFENING GIRDER

HIGH LOAD MULTI-ROTATIONAL (HLMR) BEARINGS WITH PTFE SLIDING SURFACES ARE PROVIDED AT THE EXPANSION END OF EACH STIFFENING GIRDER CARRYING VERTICAL LOADS ONLY. PIN BEARINGS ARE PROVIDED AT THE FIXED END OF EACH STIFFENER GIRDER, PROVIDING VERTICAL AND LONGITUDINAL RESTRAINT.

BIKE TRAIL

ELASTOMERIC BEARINGS WITH A PTFE SLIDING SURFACE ARE PROVIDED AT BOTH ENDS OF THE BIKE TRAIL.

23. JOINTS

A MODULAR EXPANSION JOINT IS PROVIDED AT THE EXPANSION END OF THE BRIDGE. A STEEL FINGER JOINT IS PROVIDED AT THE FIXED END OF THE BRIDGE TO ACCOMMODATE APPROACH SPAN EXPANSION AND GIRDER ROTATIONS. THE JOINTS SHALL BE SET AT CONSTRUCTION SUCH THAT THEY WILL BE CENTERED AT 50 DEGREES FAHRENHEIT.

24. COMPONENT REPLACEMENT

PROVISIONS HAVE BEEN MADE TO ALLOW REPLACEMENT OF COMPONENTS SUCH AS BEARINGS, JOINTS AND HANGERS. AS THE BRIDGE IS DESIGNED FOR REDUNDANCY IN THE HANGERS, SINGLE HANGER REPLACEMENT WILL BE PERFORMABLE ONE HANGER AT A TIME UNDER NORMAL TRAFFIC. FOR BEARING REPLACEMENT, SUFFICIENT BEARING AREA TO LOCATE JACKS IS PROVIDED.

25. BIKE TRAIL/OVERLOOK RAILINGS

APPROVED AESTHETIC BIKE TRAIL/OVERLOOK RAILINGS ARE DESIGNED PER THE REQUIREMENTS OF AASHTO LRFD ARTICLES 13.8, 13.9, AND 13.10.

NOTES:

FOR GENERAL NOTES, SEE DESIGN SHEETS 8 AND 9.

MODJESKI and MASTERS
Experience great bridges.

SUPERSTRUCTURE DESIGN FOR 0° SKEW
795'-0 x 72'-0 STEEL ARCH BRIDGE
WITH 14'-0 BIKE TRAIL
DESIGN CRITERIA
EASTBOUND ARCH SUPERSTRUCTURE
STATION: 6770+98.50 52' RIGHT - CL I-74 DECEMBER 2016
SCOTT & ROCK ISLAND COUNTIES
IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION
DESIGN SHEET NO. 4 OF 188 FILE NO. 30253 DESIGN NO. 717

DESIGN TEAM PAR/EAR /TPM | SCOTT & ROCK COUNTIES | PROJECT NUMBER IM-NHS-074-1(198)5--03-82 | SHEET NUMBER 251

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CHANGED BY ADDENDA 4/4/2017