DESIGN SPECIFICATION FOR COMPOSITE ARCH BRIDGE SYSTEM

1.0 GENERAL

A. THIS WORK SHALL CONSIST OF PROCURING AND DESIGNING THE COMPOSITE ARCH BRIDGE SYSTEM IN ACCORDANCE WITH THESE SPECIFICATIONS AND IN CONFORMITY WITH THE LOVE, GRADES, AND DIMENSIONS SHOWN ON THE CONTRACT DRAWINGS. THE COMPOSITE ARCH BRIDGE SYSTEM IS SUPPLIED BY:

B. ADVANCED INFRASTRUCTURE TECHNOLOGIES (AIT), LLC
20 GODFREY DRIVE
ORONO, MAINE 04473
PHONE: 207.866.6524 FAX: 207.866.6501
WWW.AITBRIDGES.COM

COMPOSITE ARCH BRIDGE SYSTEM WILL BE LIMITED TO SPANS NOT TO EXCEED 60'-0" WITH A SPAN LIMIT OF 50 DEGREES

C. THE BRIDGE SYSTEM SHALL BE DESIGNED BY AIT IN ACCORDANCE WITH PENNDOT DESIGN MANUAL PART 4 - STRUCTURES (DM-4) ASHTO LRBD BRIDGE DESIGN SPECIFICATIONS ASHTO LRBD SPECIFICATIONS FOR DESIGN OF CONCRETE-FILLED FRP TUBES FOR FLEXURAL AND AXIAL MEMBERS, AND OTHER SPECIFICATIONS. THE COMPOSITE ARCH BRIDGE SHALL BE DESIGNED BY A LICENSED PROFESSIONAL ENGINEER. DRAWINGS PACKAGES AND DRAWINGS SHALL BE PROVIDED TO THE CUSTOMER BY AIT FOR THE BRIDGE SYSTEM SUPPLIED. AS SUPPLIED, AIT WILL DELIVER TO THE CUSTOMER ALL PARTS OF THE BRIDGE SYSTEM AS DESIGNED IN THE CONTRACT DRAWINGS. EACH COMPONENT IS CUSTOM DESIGNED, DETAILLED, AND FABRICATED FOR THE SPECIFIC BRIDGE PROJECT.

D. THE COMPOSITE ARCH BRIDGE SYSTEMS ARE BURIED BRIDGE STRUCTURE CONSISTING OF TWO COMPONENTS

1. ARCHES - THE ADVANCED FRP COMPOSITE TUBES DESIGNED, MANUFACTURED, AND DELIVERED BY AIT
2. DECKING PANELS - THE DECKING PANELS ARE CUSTOM DESIGNED, MANUFACTURED AND DELIVERED BY AIT

E. TERMS FOUND WITHIN THIS SPECIFICATION SHALL BE DEFINED AS FOLLOWS:

COMPOSITE ARCHES - A HOLLOW ADVANCED FRP TUBE STRUCTURAL MEMBER COMPRISING OF AN ADVANCED FIBER REINFORCED POLYMER SHELL WHICH FUNCTIONS AS EXTERNAL REINFORCEMENT AND STAY-IN-PLACE FORM FOR EXPANSIVE SELF CONSOLIDATING CONCRETE.

2.0 COMPOSITE ARCHES

A. THIS WORK SHALL CONSIST OF DESIGNING THE COMPOSITE ARCH TUBES TO THE DIMENSIONS, DETAILS, AND QUANTITIES SHOWN ON THE PLANS AND ACCORDING TO THE REQUIREMENTS OF THESE SPECIFICATIONS.

2.1 DESIGN

A. DESIGN LOADS ARE IN ACCORDANCE WITH PENNDOT DM-4-3 AND ASHTO LRBD BRIDGE DESIGN SPECIFICATIONS, PA-09 USE LOADING. ARCH DESIGN IS IN ACCORDANCE WITH THE ASHTO LRBD GUIDE SPECIFICATIONS FOR DESIGN OF CONCRETE-FILLED FRP TUBES FOR FLEXURAL AND AXIAL MEMBERS, SUPPLEMENTED BY LABORATORY TESTING AS NECESSARY.

B. PROVIDE A SUITABLE DRAINAGE PIPE AT REGULAR INTERVALS (NOT TO EXCEED 10'-0") ALONG THE ARCH TO RELEASE HYDROSTATIC PRESSURE. WHERE SIGNIFICANT SEEPAGE OR RELATIVELY RAPID ACCUMULATION OF WATER IS ANTICIPATED BEHIND THE WALL, INCORPORATE DRAINAGE PIPE AS SPECIFIED INTO THE 2'-0" MINIMUM WIDTH OF SELECT BACKFILL, IMPROVE DRAINAGE CONDITIONS, DIRECT SEEPAGE FROM DRAINAGE PIPE TO WEEP HOLES ALONG THE EXTERIOR FACE OF THE WALL OR TO THE STORM WATER CONDUITS.

C. PROVIDE A SUITABLE DRAINAGE PIPE ALONG THE CURB AND PARAPET THAT MEETS THE DEPARTMENT STANDARD SHAPE, SIZE AND REINFORCEMENT.

D. PROVIDE MINIMUM COVER OF 1'-6" FROM TOP OF THE COMPOSITE ARCH UNIT CROWN TO TOP OF PAVEMENT.

E. PROVIDE A SUITABLE DRAINAGE PIPE AT REGULAR INTERVALS (NOT TO EXCEED 10'-0") ALONG THE ARCH TO RELEASE HYDROSTATIC PRESSURE. WHERE SIGNIFICANT SEEPAGE OR RELATIVELY RAPID ACCUMULATION OF WATER IS ANTICIPATED BEHIND THE WALL, INCORPORATE DRAINAGE PIPE AS SPECIFIED INTO THE 2'-0" MINIMUM WIDTH OF SELECT BACKFILL, IMPROVE DRAINAGE CONDITIONS, DIRECT SEEPAGE FROM DRAINAGE PIPE TO WEEP HOLES ALONG THE EXTERIOR FACE OF THE WALL OR TO THE STORM WATER CONDUITS.

F. THE CHIEF BRIDGE ENGINEER IS TO BE ARBITER AND HIS DECISION IS TO BE FINAL.

G. DESIGN AND RATE THE ARCH SEGMENTS FOR PHL-93 AND P-82 LOADING, COMPLY WITH THE DESIGN CRITERIA IN DESIGN MANUAL PART 4M.

H. IN THE EVENT THAT CERTAIN DESIGN PARAMETERS, STRESSES OR SPECIFICATIONS ARE IN CONFLICT, THE FOLLOWING ORDER OF PREDOMINANCE GOVERNS:

1. DESIGN REQUIREMENTS LISTED IN "SPECIAL DRAWINGS AND SPECIAL DESIGN REQUIREMENTS" OF THE SPECIAL PROVISION.

2. DESIGN RELATED STRESSES ON LETTERS IN EFFECT ON THE DATE OF PROJECT ADVERTISEMENT.

3. PENNDOT - DESIGN MANUAL PART 4-STRUCTURES.

4. PENNDOT - DESIGN STANDARDS.

5. ASHTO LRBD BRIDGE DESIGN SPECIFICATIONS (2ND EDITION), ASHTO LRBD GUIDE SPECIFICATIONS FOR DESIGN OF CONCRETE-FILLED FRP TUBES FOR FLEXURAL AND AXIAL MEMBERS.

6. IN THE EVENT THAT A CLEAR ORDER OF PREDOMINANCE CANNOT BE ESTABLISHED OR DIFFERENCE IN THE INTERPRETATION OF THE DESIGN CANNOT BE RESOLVED, THE CHIEF BRIDGE ENGINEER IS TO BE ARBITER AND HIS DECISIONS TO BE FINAL.

7. PROVIDE A SUITABLE DRAINAGE PIPE AT REGULAR INTERVALS (NOT TO EXCEED 10'-0") ALONG THE ARCH TO RELEASE HYDROSTATIC PRESSURE. WHERE SIGNIFICANT SEEPAGE OR RELATIVELY RAPID ACCUMULATION OF WATER IS ANTICIPATED BEHIND THE WALL, INCORPORATE DRAINAGE PIPE AS SPECIFIED INTO THE 2'-0" MINIMUM WIDTH OF SELECT BACKFILL, IMPROVE DRAINAGE CONDITIONS, DIRECT SEEPAGE FROM DRAINAGE PIPE TO WEEP HOLES ALONG THE EXTERIOR FACE OF THE WALL OR TO THE STORM WATER CONDUITS.

8. PROVIDE A SUITABLE DRAINAGE PIPE ALONG THE CURB AND PARAPET THAT MEETS THE DEPARTMENT STANDARD SHAPE, SIZE AND REINFORCEMENT.
MATERIAL NOTES:
1. ALL SELECT GRANULAR BACKFILL MATERIAL USED IN THE STRUCTURE VOLUME SHALL BE FREE FROM ORGANIC OR OTHERWISE DELETERIOUS MATERIAL AND SHALL CONFORM TO THE FOLLOWING GRADATION LIMITS AS DETERMINED BY AASHTO T-27.

<table>
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<tr>
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<td>60-100%</td>
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<tr>
<td>No. 30</td>
<td>60-10%</td>
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FURNISH MATERIALS MEETING THE QUALITY REQUIREMENTS OF TYPE C COARSE AGGREGATE OR BETTER AS SPECIFIED IN SECTION 703.2(A), TABLE B, EXCEPT FURNISH MATERIALS FREE OF CLAY LUMPS, FRIABLE PARTICLES, COAL AND COKE.

ARCH FILLING NOTES:
1. SELF-CONSOLIDATING CONCRETE MAY BE PLACED BY PUMP OR WITH A CONCRETE BUCKET AND FUNNEL.
2. EACH ARCH WILL BE PLACED INSIDE THE SPLICE COLLAR AND VERIFY EXTERNAL ARCH GEOMETRY PRIOR TO FILLING THE ARCH WITH SELF-CONSOLIDATING CONCRETE.
3. THE SPARGE PIPE SHOULD BE 2" IN DIAMETER AND MAY BE PLACED IN THE ADJACENT CORRUGATION FOR AIR VENTING.
4. ARCHES CAN BE INSPECTED FOR VOIDS AFTER FILLING BY TAPPING THE ARCH AND LISTENING FOR A HOLLOW SOUND. REPAIR IN ACCORDANCE WITH THE SPECIFICATIONS.

MANUFACTURING AND CONSTRUCTION TOLERANCES AND INSPECTION DETAILS:
1. EACH ARCH WILL BE MEASURED TO CONFORM TO THE DIMENSIONAL TOLERANCES SPECIFIED. DIMENSIONS OUTSIDE THE FOLLOWING LIMITS WILL BE SUBJECT TO REJECTION OR REPAIR:

<table>
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<th>LENGTH</th>
<th>0-0.5% OF THE GIVEN DIMENSION</th>
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<tbody>
<tr>
<td>WIDTH</td>
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<tr>
<td>RISE</td>
<td>0-0.5% OF THE GIVEN DIMENSION</td>
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SUGGESTED CONSTRUCTION SEQUENCE:
1. FORM FOUNDATIONS AND PLACE REBAR
2. INSERT END REINFORCEMENT CAGES INTO ARCH ENDS AND INSTALL ARCHES IN FOOTINGS
3. ATTACH DECKING TO ARCHES
4. POURED FOUNDATIONS
5. DRILL 2" HOLE AT APEX OF ARCH AND INSTALL ARCHES WITH SELF-CONSOLIDATING CONCRETE. CONSTRUCT IN ACCORDANCE WITH PUB 408 714.7(a)2 AND SECTION 1001 FOR GUIDANCE OF FIELD USE. ACHIEVE 2000 PSI STRENGTH IN FIELD CYLINDER TEST BEFORE BACKFILLING
6. ERECT HEADWALLS
7. BACKFILL STRUCTURE AND PLACE SOIL REINFORCEMENT LAYERS PER RC-12M. BACKFILL ARCH IN MAXIMUM 1'-0" LOOSE LIFT, ALTERNATING LIFTS ON EACH SIDE OF THE ARCH TO MAINTAIN BALANCED LOADING. THE MAXIMUM DEVIATION FROM EQUAL BACKFILLING WILL BE 2'-0". ACHIEVE THE BACKFILL COMPACTED WITHIN THE 4'-0" ON EACH SIDE OF ARCH UNIT AND OVER THE TOP OF THE ARCH UNIT. UNTIL IT IS COVERED TO A MINIMUM DEPTH OF 6" BY USING AT LEAST THREE PASSES WITH LIGHT MECHANICAL TAMPERERS. ROLLERS OR VIBRATORY SYSTEM. ACCOMPANY BACKFILL COMPACTION WITHOUT DISTURBANCE OR DISTORTION OF THE ARCH COMPONENTS
8. INSTALL FASCIA PLATES

ARCH MATERIALS SHALL CONFORM TO SECTION 3: MATERIAL SPECIFICATIONS OF AASHTO LRFD GUIDE SPECIFICATIONS WHEN CONSTRUCTED.

HEADWALL ARCH CONNECTION NOTES:
1. ATTACH STAINLESS STEEL ANGLES TO DECKING PER DESIGN
2. ATTACH FASCIA PLATE TO STAINLESS STEEL ANGLES USING 1" STAINLESS STEEL SELF DRILLING SCREWS THROUGH HOLES IN THE ANGLE
3. PLACE NON-SHRINKING GROUT ALONG OUTER EDGE AS DETAILED PER DESIGN WITH A MINIMUM OF 4" BEYOND THE INSIDE FACE OF THE HEADWALL PANEL AND SLOPED OFF AT A 1:1
4. ERECT HEADWALL PANELS AND PLACE DRAINAGE
5. SEAL BETWEEN THE TOP EDGE OF FASCIA PLATE AND THE HEADWALL PANEL ALONG THE ENTIRE ARCH LENGTH OF THE ARCH WITH AN APPROVED SEALANT PER SECTION 705.4(a) OF PUB 408

SHEAR BOLT INSTALLATION NOTES:
NOTE: FOR SKEWED BRIDGES ONLY
1. PLACE ARCHES AND DECKING
2. DRILL PLACEMENT HOLES FOR EACH SHEAR BOLT SPACED PER DESIGN NOTE: PLACEMENT HOLES SHOULD BE THE SAME DIAMETER AS THE SHEAR BOLT TO ENSURE A TIGHT FIT
3. PRIOR TO FILLING THE ARCH WITH SELF-CONSOLIDATING CONCRETE, INSTALL SHEAR BOLTS

SPICE INSTALLATION NOTES:
NOTE: FOR SPLICED ARCHES ONLY
1. CLEAR A LEVEL AREA TO SPICE THE ARCHES PRIOR TO ERECTION
2. TAKING TWO ARCH HALVES, SPLICE REINFORCEMENT, AND ONE SPICE COLLAR, FIT THE SPICE REINFORCEMENT AND TWO HALVES INSIDE THE SPICE COLLAR AND VERIFY EXTERNAL ARCH GEOMETRY
3. DRILL AND PLACE BLIND RIVET FASTENERS PER DESIGN
4. ERECT ARCH INTO FINAL POSITION AND CONTINUE TO ITEM 2 OF SUGGESTED CONSTRUCTION SEQUENCE

SPICE INSTALLATION NOTES:
NOTE: FOR SPLICED ARCHES ONLY
1. CLEAR A LEVEL AREA TO SPICE THE ARCHES PRIOR TO ERECTION
2. TAKING TWO ARCH HALVES, SPLICE REINFORCEMENT, AND ONE SPICE COLLAR, FIT THE SPICE REINFORCEMENT AND TWO HALVES INSIDE THE SPICE COLLAR AND VERIFY EXTERNAL ARCH GEOMETRY
3. DRILL AND PLACE BLIND RIVET FASTENERS PER DESIGN
4. ERECT ARCH INTO FINAL POSITION AND CONTINUE TO ITEM 2 OF SUGGESTED CONSTRUCTION SEQUENCE

FINISHING NOTES:
1. ARCH MATERIALS SHALL CONFORM TO SECTION 3: MATERIAL SPECIFICATIONS OF AASHTO LRFD GUIDE SPECIFICATIONS FOR DESIGN OF CONCRETE-FILLED FRP TUBES FOR FLEXURAL AND AXIAL MEMBERS.

PROJECT: Sample  
LOCATION: Sample  
TITLE: COMPOSITE ARCH BRIDGE SYSTEM ARCH DETAILS  
INITIALS  
DATE  
DRAWN BY: TAK  3-25-2014  
DESIGNED BY: ZBU  3-25-2014  
CHECKED BY: KLS  6-19-2014  
Correct scale on size B paper (11x17 Ledger)
DECK NOTES:
- PROJECT TO INCLUDE "X" TOTAL DECK PANELS WITH DIMENSIONS 3.75" X 19.5" X "DECK WIDTH"
- BRIDGE WIDTH TO BE SPANNED BY "X" PANEL(S)

6" x 2" BRIDGE WIDTH FRP CLOSURE PLATE USING E-Glass ACCORDING TO ASTM D578-98 PARAGRAPH 4.2.2 AND DEREKANE 601C-300 VINYL ESTER RESIN

2" STAINLESS STEEL SELF-DRILLING SCREWS ACCORDING TO ASTM F593 NUMBER REQUIRED DETAILED PER DESIGN

CONTINUOUS BEAD OF PLOGRIP 7770 STRUCTURAL ADHESIVE PLACED AT EACH PANEL OVERLAP ACCORDING TO ASTM D638

STAINLESS STEEL SHEAR BOLT ACCORDING TO ASTM F593 SIZED AND SPACED PER DESIGN

NOTE: FOR SKEWED BRIDGES ONLY

PROJECT: Sample JN: YR-XXX (EG. 13020)
LOCATION: Sample
TITLE: COMPOSITE ARCH BRIDGE SYSTEM DECKING DETAILS

Correct scale on size B paper (11x17 Ledger)
ELEVATION OF FINISHED ABUTMENT

LOCATOR HOLE ELEVATION

FASCIA PLATE INSTALLATION ELEVATION

ARCH LENGTH ALONG SPINE REQUIRES "X" PANELS PER SIDE

FASCIA PLATE JOINT TYP

FASCIA PLATE JOINT CENTERED AT CROWN

ELEVATION OF FINISHED ABUTMENT

LOCATOR HOLE ELEVATION

FASTEN TO HEADWALL PANEL WITH 1" STAINLESS STEEL SELF-DRILLING SCREWS (3 PER PLATE) ASTM F93 LOCATED PER DESIGN

FIELD TRIM TO MATCH FOOTING

FASCIA PLATE NOTES:
- PROJECT TO INCLUDE "X" TOTAL ¾" THICK E-GLASS PANELS ACCORDING TO ASTM D578-98 WITH DEREKANE 610C-200 VINYL ESTER RESIN

1" OR 1 3/16" Ø HUCK BA-BOM R10-14 BLIND RIVET WITH ASTM F436 1 1/32" Ø WASHER

PER DESIGN

4.25" CIRCUMFERENTIALY

LIMITS OF MATING ARCH HALVES

ARCH CONSTRUCTION SPLICE ELEVATION

IF NECESSARY FOR SHIPPING
NOTE: LOCATION DETAILED PER DESIGN

ARCH CONSTRUCTION SPLICE SECTION

IF NECESSARY FOR SHIPPING
NOTE: DESIGNER TO DETAIL
REINFORCEMENT CAGE TO PROVIDE MINIMUM CLEAR COVER

1/8" EDGE DISTANCE

BLIND RIVETS ACCORDING TO ASTM F436 PER DESIGN

SPIRAL REINFORCEMENT ACCORDING TO SECTION 709.1(f) OR 709.1(g) OF PUB 408

LONGITUDINAL REINFORCEMENT ACCORDING TO SECTION 709.1(f) OR 709.1(g) OF PUB 408

PER DESIGN

ASTM A307 5/16 HUCK BA-BOM R10-14 BLIND RIVET WITH ASTM F436 1 1/32" Ø WASHER

PER DESIGN

PROJECT: Sample JN: YR-XXX (EG. 13020)
LOCATION: Sample
DRAWING STATUS: Sample
INITSIALS: TAK
DATE: 3-25-2014
HENDOT DRAWING 2013-236

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