KYTC Approved Three-Sided Culverts
August 24, 2012

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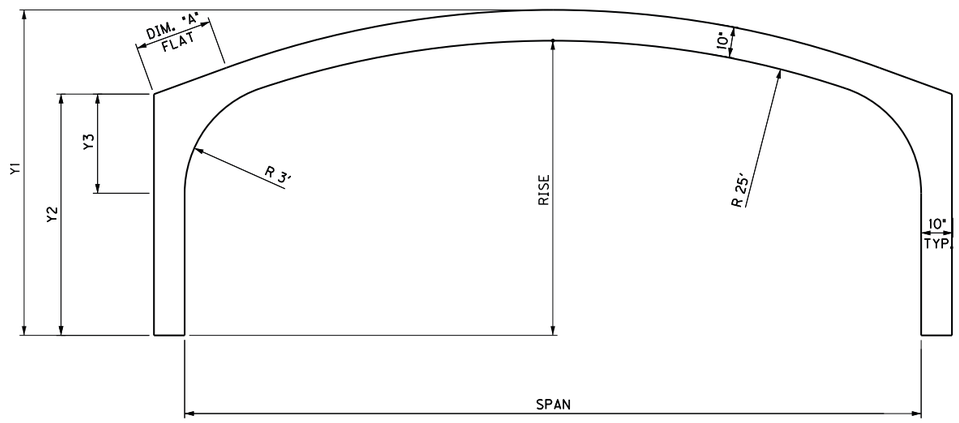
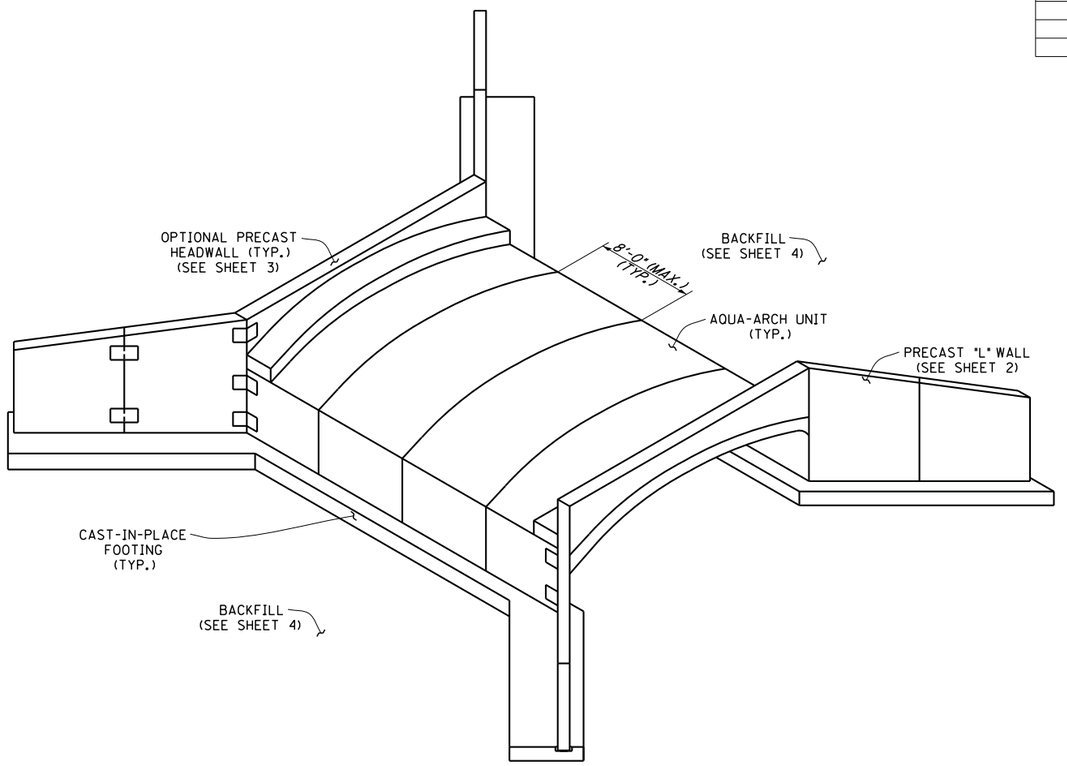
AQUA – ARCH DRAWINGS AND DETAILS



AQUA-ARCH TYPICAL SECTION
SHOWING DIMENSIONS N.T.S



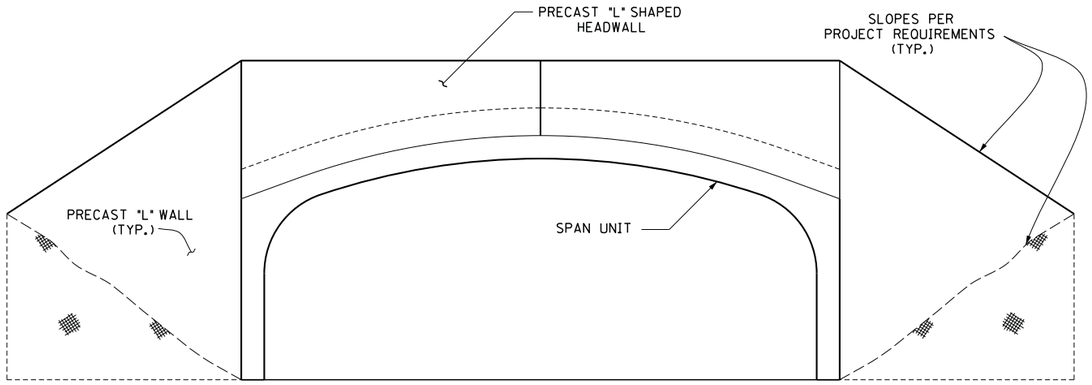
AQUA-ARCH ISOMETRIC
SHOWING COMPONENTS N.T.S

SPAN=16 FT.					
RISE (FT)	Y1	Y2	Y3	A	WATERWAY (SF)
5	5'-10"	4'-3 5/16"	2'-9 5/8"	0'-0"	71.04
6	6'-10"	5'-3 5/16"	2'-9 5/8"	0'-0"	87.04
7	7'-10"	6'-3 5/16"	2'-9 5/8"	0'-0"	103.04
8	8'-10"	7'-3 5/16"	2'-9 5/8"	0'-0"	119.04
9	9'-10"	8'-3 5/16"	2'-9 5/8"	0'-0"	135.04
10	10'-10"	9'-3 5/16"	2'-9 5/8"	0'-0"	151.04

SPAN=20 FT.					
RISE (FT)	Y1	Y2	Y3	A	WATERWAY (SF)
5	5'-10"	3'-6 9/16"	2'-8 1/8"	2'-1 1/2"	84.74
6	6'-10"	4'-6 9/16"	2'-8 1/8"	2'-1 1/2"	104.74
7	7'-10"	5'-6 9/16"	2'-8 1/8"	2'-1 1/2"	124.74
8	8'-10"	6'-6 9/16"	2'-8 1/8"	2'-1 1/2"	144.74
9	9'-10"	7'-6 9/16"	2'-8 1/8"	2'-1 1/2"	164.74
10	10'-10"	8'-6 9/16"	2'-8 1/8"	2'-1 1/2"	184.74
11	11'-10"	9'-6 9/16"	2'-8 1/8"	2'-1 1/2"	204.74

SPAN=24 FT.					
RISE (FT)	Y1	Y2	Y3	A	WATERWAY (SF)
5	5'-10"	2'-9 13/16"	2'-8 15/16"	4'-3 1/16"	94.88
6	6'-10"	3'-9 13/16"	2'-8 15/16"	4'-3 1/16"	118.88
7	7'-10"	4'-9 13/16"	2'-8 15/16"	4'-3 1/16"	142.88
8	8'-10"	5'-9 13/16"	2'-8 15/16"	4'-3 1/16"	166.88
9	9'-10"	6'-9 13/16"	2'-8 15/16"	4'-3 1/16"	190.88
10	10'-10"	7'-9 13/16"	2'-8 15/16"	4'-3 1/16"	214.88
11	11'-10"	8'-9 13/16"	2'-8 15/16"	4'-3 1/16"	238.88

DIMENSIONS AND WATERWAY AREAS



END ELEVATION

GENERAL NOTES

1. DESIGN SPECIFICATION: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS , 2004 EDITION W/CURRENT INTERIMS THRU 2006.
2. DESIGN LIVE LOAD: HL-93.
3. INSTALLATION TO BE IN ACCORDANCE WITH PRODUCT INSTALLATION GUIDELINES. SEE SHEET NO. 4 FOR ADDITIONAL REQUIREMENTS.
4. SEE SHEET 4 FOR MATERIALS SPECIFICATIONS.
5. STRUCTURAL DESIGN BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF KENTUCKY TO BE PROVIDED BY SHERMAN DIXIE CONCRETE INDUSTRIES UPON SUBMITTAL OF SHOP DRAWINGS FOR EACH SITE.

PH# 1-800-737-0707

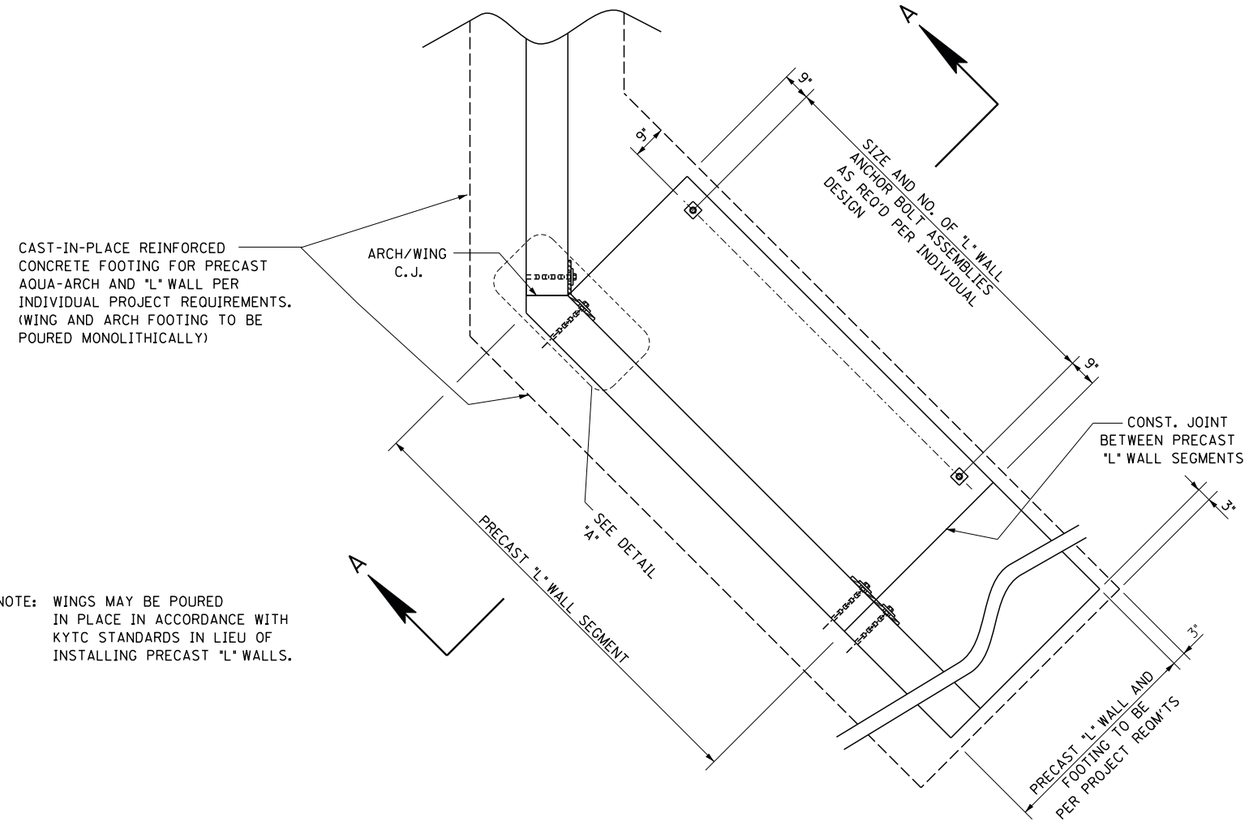
GENERAL LAYOUT AND DETAILS

AQUA-ARCH DESIGN SCHEMATICS
KENTUCKY TRANSPORTATION CABINET

ISSUE / REVISIONS

NO.	DESCRIPTION	DATE	BY
1	ORIGINAL ISSUE	02/26/07	WAP

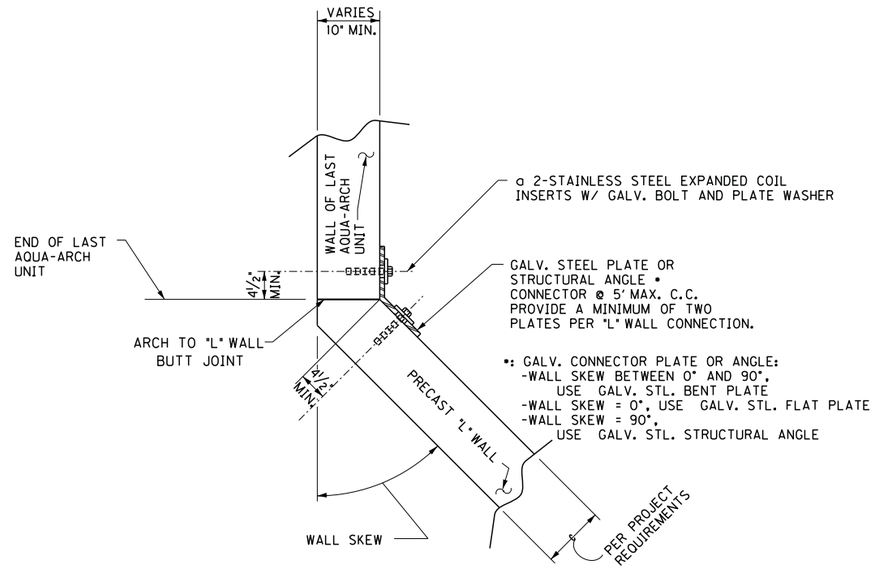
SHEET 1 OF 4



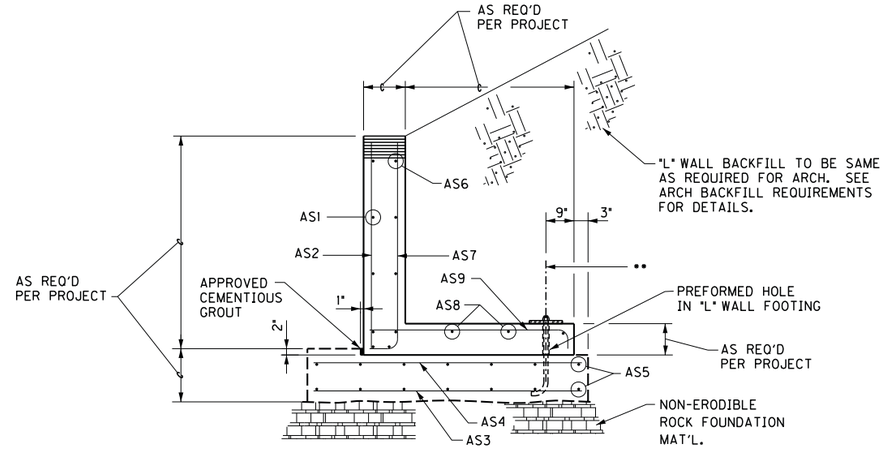
NOTE: WINGS MAY BE POURED IN PLACE IN ACCORDANCE WITH KYTC STANDARDS IN LIEU OF INSTALLING PRECAST "L" WALLS.

PARTIAL PLAN @ END OF AQUA-ARCH

SHOWING PRECAST "L" WALL INSTALLATION N.T.S



DETAIL "A"
PRECAST "L" WALL TO AQUA-ARCH ATTACHMENT



NOTE: REINFORCING STEEL AREAS A1 THRU A9 TO BE DETERMINED PER PROJECT REQUIREMENTS. STEEL AREAS A1 THRU A5 MAY BE SUPPLIED AS EITHER W.W.F., OR DEFORMED STEEL BARS PER THE KYTC SPECIFICATIONS. STEEL AREAS A6 AND A9 SHALL BE PROVIDED AS DEFORMED STEEL BARS ONLY.

•• : INDICATES ⓐ OF ANCHOR BOLT ASSEMBLY FOR PRECAST "L" WALL FOOTING. ASSEMBLY TO CONSIST OF GALV. ANCHOR BOLT W/GALV. STL. WASHER PLATE AND NUT. IN LIEU OF C.I.P. ANCHOR, THE CONTRACTOR MAY ELECT TO DRILL AND INSTALL APPROVED EPOXY CAPSULE ANCHOR THRU PREFORMED HOLE IN "L" WALL FOOTING.

PREFORMED HOLE TO BE GROUTED SOLID AROUND ANCHOR BOLT PRIOR TO PLACING WASHER PLATE.

SECTION A-A

PH# 1-800-737-0707

PRECAST "L" WALL DETAILS

AQUA-ARCH DESIGN SCHEMATICS
KENTUCKY TRANSPORTATION CABINET

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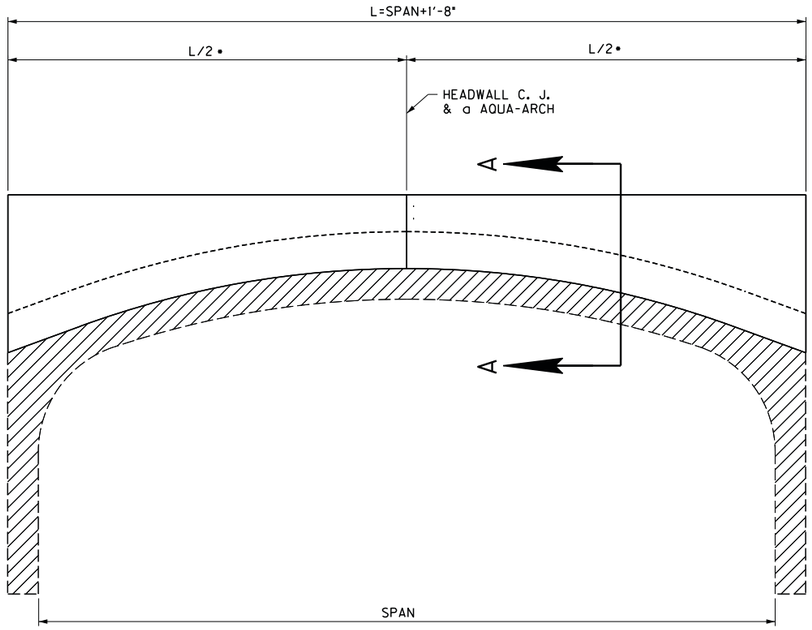
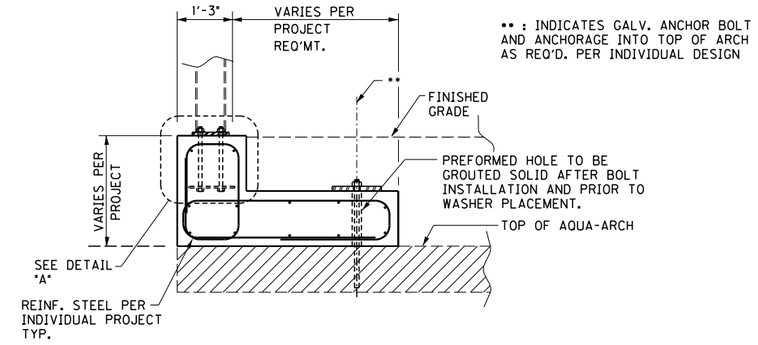
NO.	DESCRIPTION	DATE	BY
1	ORIGINAL ISSUE	02/26/07	WAP

SHEET 2 OF 4

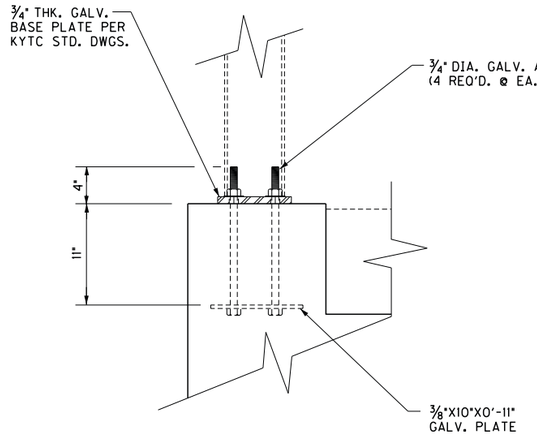


•: THE PRECAST HEADWALL MAY BE SUPPLIED IN EITHER ONE CONTINUOUS MEMBER OR IN TWO EQUAL PIECES AS SHOWN

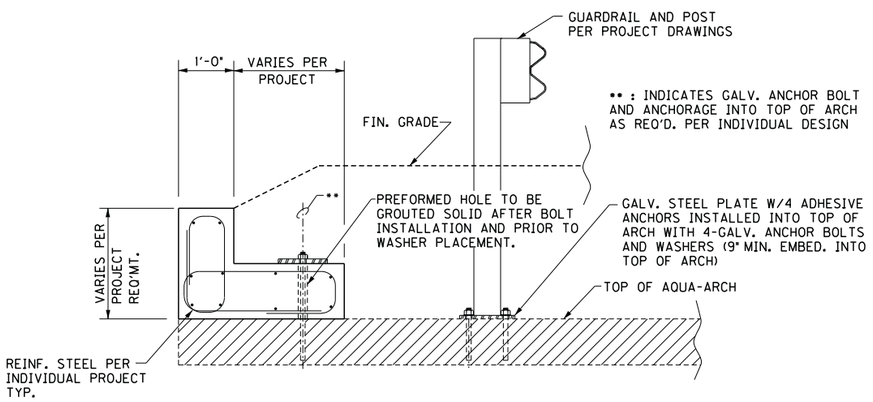
TYPICAL ELEVATION AT PRECAST HEADWALL



SECTION A-A SHOWING GUARDRAIL ATTACHED TO TOP/HEADWALL



DETAIL "A"



SECTION A-A SHOWING GUARDRAIL ATTACHED TO TOP OF ARCH

HEADWALL & GUARDRAIL ATTACHMENT DETAILS

AQUA-ARCH DESIGN SCHEMATICS
KENTUCKY TRANSPORTATION CABINET

PH# 1-800-737-0707

ISSUE / REVISIONS

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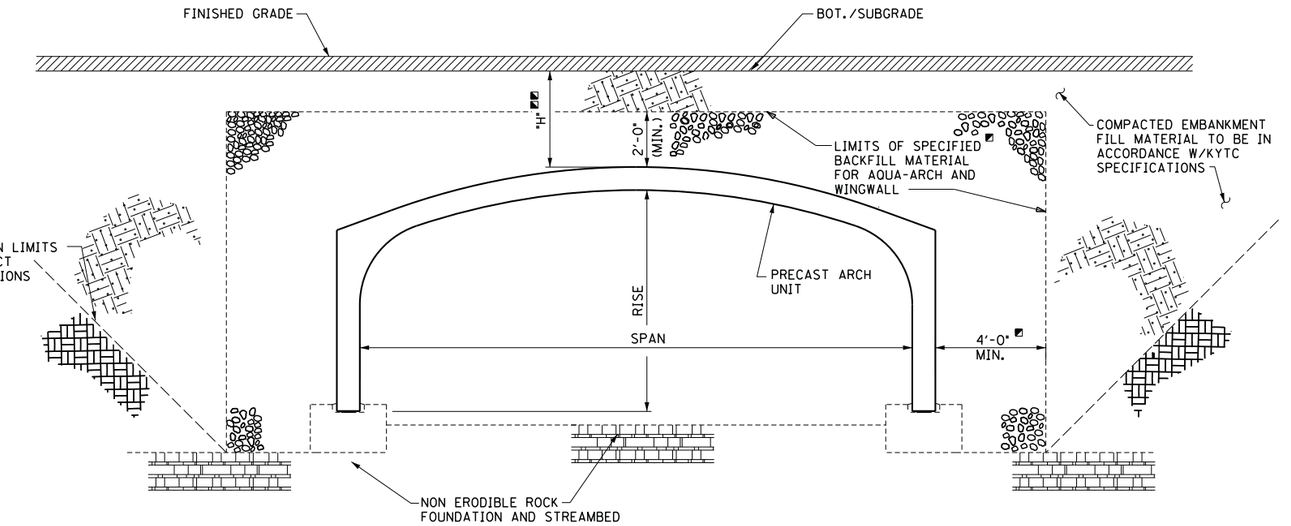
1	ORIGINAL ISSUE	02/26/07	WAP

SHEET 3 OF 4



◩◩: FOR FILL HEIGHT, H<2.0', PLACE SPECIFIED ARCH BACKFILL MATERIAL TO BOTTOM OF ROADWAY SUBGRADE.

MAXIMUM FILL, "H"=30'-0".

◩: BACKFILL MATERIAL TO BE IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS AS DESIGNATED IN CHAPTER M-145-91 OF THE AASHTO STANDARD SPECIFICATIONS FOR TRANSPORTATION MATERIALS AND METHODS OF SAMPLING AND TESTING:
FOR H<12'-0" SOIL GROUPS A1,A2,A3 OR A4
FOR H>12'-0" SOIL GROUPS A1 OR A3

TYPICAL SECTION SHOWING BACKFILL REQUIREMENTS

GENERAL MATERIALS REQUIREMENTS

1. MATERIALS SPECIFICATIONS: ALL CONSTRUCTING MATERIALS SHALL BE IN ACCORDANCE WITH THE KTYC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, THE KYTC LIST OF APPROVED MATERIALS, AND ALL APPLICABLE ASTM AND AASHTO STANDARDS.

2. PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED BY SHERMAN DIXIE CONCRETE INDUSTRIES, A KYTC APPROVED FABRICATOR, IN ACCORDANCE WITH THE PLANS AND IN STRICT COMPLIANCE WITH SECTION 605 OF THE KYTC, DEPARTMENT OF HIGHWAYS, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

3. ALL MATERIALS SHALL BE PROVIDED IN ACCORDANCE WITH SECTION 106.4 OF THE KYTC STANDARD SPECIFICATIONS BUY AMERICA REQUIREMENT.

4. CONCRETE TO BE IN ACCORDANCE WITH SECTION 601 OF THE KYTC SPECIFICATIONS. REQUIRED MINIMUM 28 DAY CONCRETE STRENGTHS TO BE AS FOLLOWS:
PRECAST ARCH UNITS: 5000 P.S.I.
PRECAST HEADWALLS AND "L" WALLS: 4000 P.S.I.
CAST-IN-PLACE FOOTINGS: 3500 P.S.I.

5. REINFORCING STEEL FOR PRECAST UNITS, HEADWALLS, AND "L"WALLS, SHALL BE EITHER WELDED WIRE FABRIC, DEFORMED WELDED WIRE FABRIC, OR DEFORMED STEEL BARS IN ACCORDANCE WITH THE KYTC SPECIFICATIONS.

6. FOUNDATIONS:
CAST-IN-PLACE FOOTINGS TO REST UPON NON-ERODIBLE ROCK FOUNDATION MATERIAL UNLESS OTHERWISE APPROVED BY THE KYTC DEPARTENT OF HIGHWAYS.

7. 4" DIA. WEEP HOLES SHALL BE PROVIDED IN AQUA-ARCH UNITS AND PRECAST "L" WALLS IN ACCORDANCE WITH SECTION 611 OF THE KYTC STANDARD SPECIFICATIONS.

BACKFILL REQUIREMENTS

1. BACKFILL OF ARCH SHALL BE IN STRICT COMPLIANCE WITH THE INSTRUCTIONS HEREIN AND IN ACCORDANCE WITH PROJECT SPECIFICATIONS. THE CONTRACTOR SHALL PROVIDE ADEQUATE TESTING AND MONITORING OF BACKFILL MATERIALS AND PLACEMENT AND COMPACTION PROCEDURES. THE CONTRACTOR SHALL NOT PROCEED WITH BACKFILL OPERATIONS WITHOUT CONTINUOUS MONITORING AND DOCUMENTATION OF THE PROPER PLACEMENT PROCEDURE AND DENSITY OF THE IN PLACE BACKFILL MATERIALS.

2. FOUNDATION MATERIAL: FOOTINGS FOR THE ARCH STRUCTURE AND WINGWALL SHALL BE CAST-IN-PLACE AND SHALL BE DESIGNED ON A PER PROJECT BASIS. FOOTINGS SHALL BE CAST UPON NON-ERODIBLE ROCK FOUNDATION MATERIAL UNLESS OTHERWISE APPROVED BY THE KYTC DEPARTMENT OF HIGHWAYS.

3. WITHIN THE LIMITS DESIGNATED IN THE TYPICAL SECTION FOR BACKFILL, THE BACKFILL MATERIAL SHALL BE IN ACCORDANCE WITH THE SPECIFIED AASHTO GRADATION. OUTSIDE OF THIS ZONE, BACKFILL SHALL BE IN ACCORDANCE WITH KYTC SPECIFICATIONS REGARDING BACKFILL.

4. SPECIFIED BACKFILL MATERIAL FOR ARCH SHALL BE PLACED IN ACCORDANCE WITH THE FOLLOWING:
   A. BACKFILL ADJACENT TO ARCH COMPONENTS SHALL BE PLACED SO AS NOT TO DAMAGE JOINT OR WATERPROOFING MATERIALS FOR THE ARCH.
   B. BACKFILL SHALL BE PLACED AND COMPACTED IN 8" LAYERS TO 95% OF THE MAXIMUM DRY DENSITY FOR THE MATERIAL USED. COMPACTION EQUIPMENT SHALL CONSIST OF MECHANICAL HAND-DRIVEN TAMPERS OR OTHER LIGHT COMPACTION EQUIPMENT UP TO NO LESS THAN H=1' ABOVE THE TOP OF ARCH. BEYOND THE 1' LIMIT, LIGHTWEIGHT VEHICULAR EQUIPMENT MAY BE USED FOR COMPACTION (I.E. EQUIPMENT WEIGHING LESS THAN 12 TONS).
   C. THE BACKFILL LEVELS AT EACH END OF ARCH SHALL BE KEPT AS CLOSE AS PRACTICABLE TO THE SAME ELEVATION AT ALL TIMES DURING THE BACKFILL OPERATIONS. THE MAXIMUM ALLOWABLE DIFFERENCE IN ELEVATIONS BETWEEN BACKFILLS AT EACH END OF ARCH SHALL BE 2'-0" AT ALL TIMES DURING BACKFILL OPERATIONS.

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GENERAL LAYOUT AND DETAILS

AQUA-ARCH DESIGN SCHEMATICS
KENTUCKY TRANSPORTATION CABINET

ISSUE / REVISIONS

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1	ORIGINAL ISSUE	02/26/07	WAP

SHEET 4 OF 4

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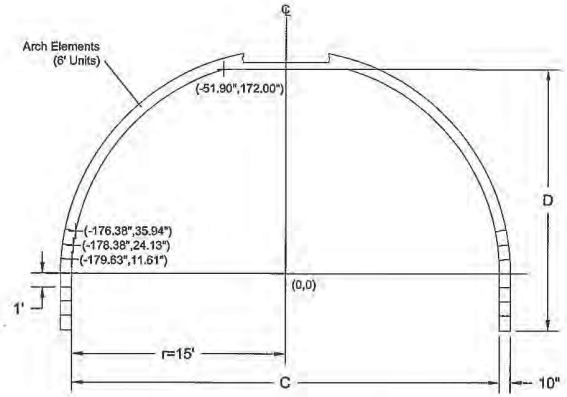
$$$$DGNSPEC$$$$

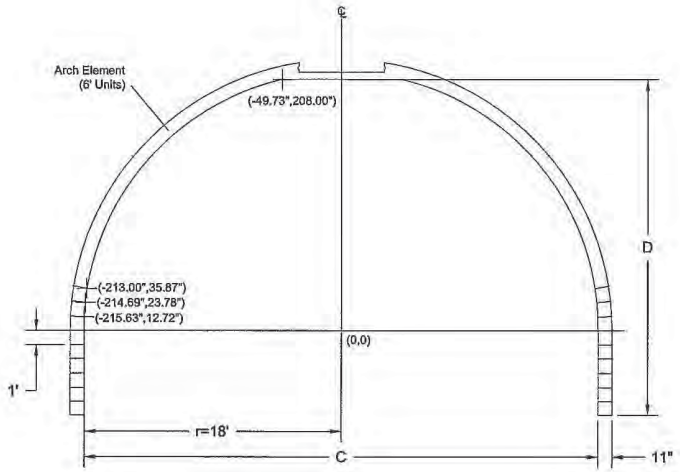
BEBO ARCH SYSTEM DRAWINGS AND DETAILS

Minimum Cover = 1.5'
Maximum Cover = 15' *

*Note: Special designs are available if additional cover is required.



C30T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
29'-4 3/4"	11'-4"	260.0
29'-8 3/4"	12'-4"	289.6
29'-11 1/4"	13'-4"	319.4
30'-0"	14'-4"	349.4
30'-0"	15'-4"	379.4
30'-0"	16'-4"	409.4
30'-0"	17'-4"	439.4
30'-0"	18'-4"	469.4



C36T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
35'-6"	14'-4"	397.1
35'-9 3/8"	15'-4"	432.8
35'-11 1/4"	16'-4"	468.6
36'-0"	17'-4"	504.6
36'-0"	18'-4"	540.6
36'-0"	19'-4"	576.6
36'-0"	20'-4"	612.6
36'-0"	21'-4"	648.1
36'-0"	22'-4"	684.6
36'-0"	23'-4"	720.6

Circle Centered @ (0,0)
$x^2 + y^2 = r^2$

BEBO® Arch Systems
CONTECH BRIDGE SOLUTIONS
3150 RESEARCH BLVD.
DAYTON, OH 45420
TEL: 800.338.1999
FAX: 937.294.8365

NO	DATE	BY	ENGINEER'S SEAL
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3			
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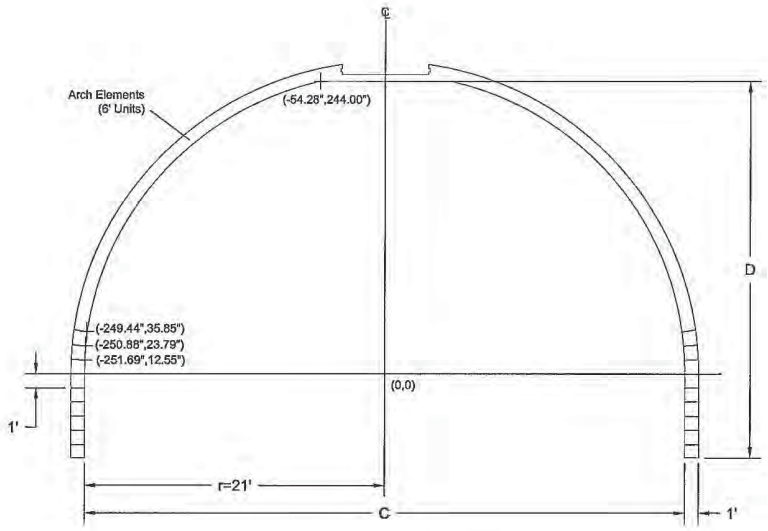
1	8/9/06	JJV	GENERAL REVISIONS

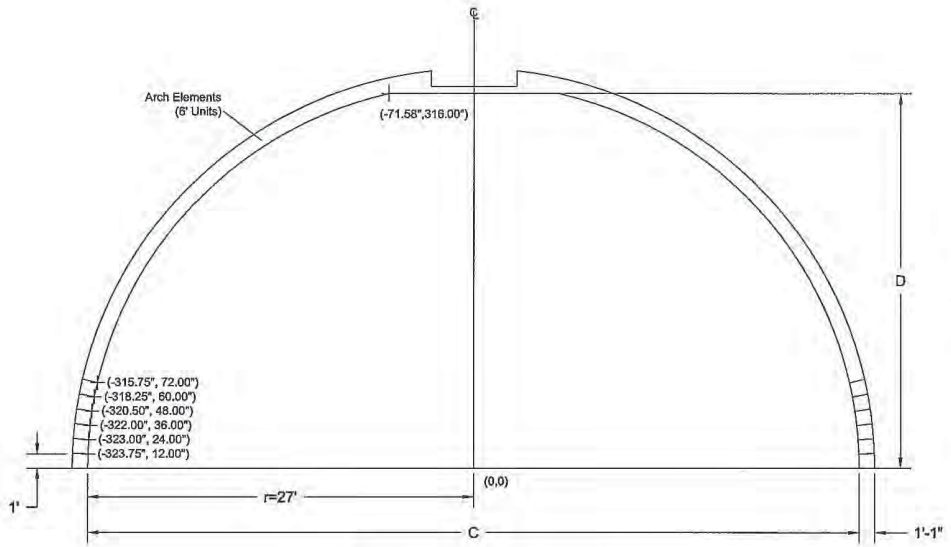
STANDARD DRAWINGS
KY TRANSPORTATION CABINET
BEBO C-SERIES GEOMETRY
JOB NO.
SHEET NO. 1 OF 15

Minimum Cover = 1.5'
Maximum Cover = 15' *

*Note: Special designs are available if additional cover is required.



C42T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
41'-7 5/16"	17'-4"	562.4
41'-10 1/16"	18'-4"	604.4
41'-11 9/16"	19'-4"	646.0
42'-0"	20'-4"	688.0
42'-0"	21'-4"	730.0
42'-0"	22'-4"	722.0
42'-0"	23'-4"	814.0
42'-0"	24'-4"	856.0
42'-0"	25'-4"	898.0
42'-0"	26'-4"	940.0



C54T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
52'-7 1/2"	20'-4"	818.45
53'-0 1/2"	21'-4"	871.31
53'-5"	22'-4"	924.55
53'-8"	23'-4"	978.05
53'-10"	24'-4"	1,031.82
53'-11 1/2"	25'-4"	1,085.75
54'-0"	26'-4"	1,139.75

Circle Centered @ (0,0)
$x^2 + y^2 = r^2$

CONTRACTOR IS TO VERIFY THAT ALL INFORMATION SHOWN ON DRAWINGS HAS BEEN THOROUGHLY CHECKED, COMPLIES WITH THE CONTRACT DOCUMENTS, AND IS APPROPRIATE TO MEET THE FIELD CONDITIONS AND REQUIREMENTS OF CONSTRUCTION. ANY DISCREPANCIES SHALL BE REPORTED TO CONTECH BRIDGE SOLUTIONS IMMEDIATELY. CONTRACTOR AND LENDERS OR OWNERS NOT TO RELY ON ELECTRONIC FILES FOR CONSTRUCTION AND LENDERS OR OWNERS RESULTING AFTER RECEIPT OF APPROVED SHOP DRAWINGS.

NOTE: PRODUCTION WILL NOT COMMENCE UNTIL RECEIPT OF STAMPED APPROVED SHOP DRAWINGS

BEBO® Arch Systems

CONTECH BRIDGE SOLUTIONS
3100 RESEARCH BLVD.
DAYTON, OH 45420
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NO	DATE	BY	
5			
4			
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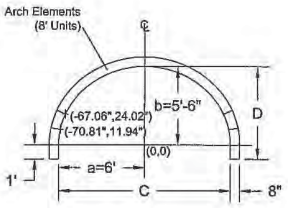
2			
1	5/6/09	JJV	GENERAL REVISIONS

STANDARD DRAWINGS
KY TRANSPORTATION CABINET
BEBO C-SERIES GEOMETRY

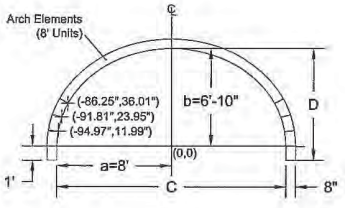
JOB NO:
SHEET NO: 2 OF 15

Minimum Cover = 1.5'
Maximum Cover = 15' *

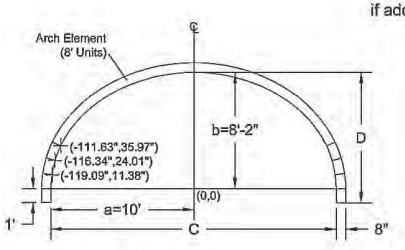
*Note: Special designs are available if additional cover is required.



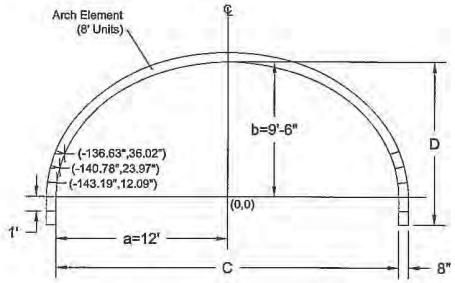
E12		
Span, C	Rise, D	Waterway Area (Sq. Ft)
11'-2 1/8"	3'-6"	28.3
11'-9 5/8"	4'-6"	39.9
12'-0"	5'-6"	51.8
12'-0"	6'-6"	63.8



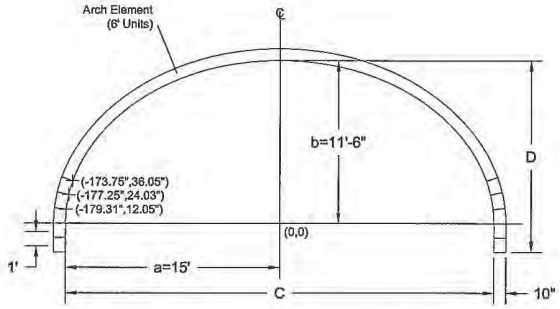
E16		
Span, C	Rise, D	Waterway Area (Sq. Ft)
14'-4 1/2"	3'-10"	39.5
15'-3 5/8"	4'-10"	54.4
15'-9 15/16"	5'-10"	70.0
16'-0"	6'-10"	85.9
16'-0"	7'-10"	101.9



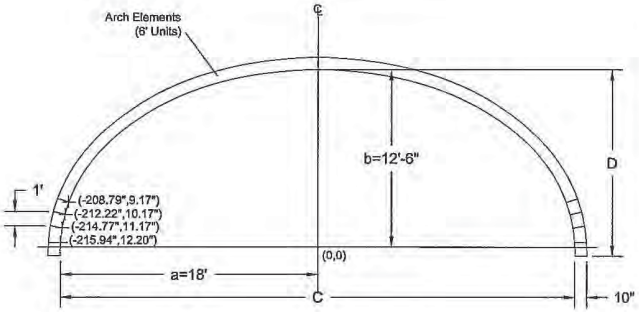
E20		
Span, C	Rise, D	Waterway Area (Sq. Ft)
18'-7 1/4"	5'-2"	69.7
19'-4 11/16	6'-2"	88.7
19'-10 3/16"	7'-2"	108.4
20'-0"	8'-2"	128.3
20'-0"	9'-2"	148.3



E24		
Span, C	Rise, D	Waterway Area (Sq. Ft)
22'-9 1/4"	6'-6"	108.3
23'-5 9/16"	7'-6"	131.5
23'-10 3/8"	8'-6"	155.2
24'-0"	9'-6"	179.1
24'-0"	10'-6"	203.1
24'-0"	11'-6"	227.1



E30		
Span, C	Rise, D	Waterway Area (Sq. Ft)
28'-11 1/2"	8'-6"	181.9
29'-6 1/2"	9'-6"	211.2
29'-10 5/8"	10'-6"	240.9
30'-0"	11'-6"	270.9
30'-0"	12'-6"	300.9
30'-0"	13'-6"	330.9



E36		
Span, C	Rise, D	Waterway Area (Sq. Ft)
34'-8 3/8"	9'-2"	234.8
35'-4 7/16"	10'-2"	269.8
35'-9 17/32"	11'-2"	305.4
35'-11 7/8"	12'-2"	341.3
36'-0"	13'-2"	377.3

Elipse Centered @ (0,0)

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1$$

CONTECH BRIDGE SOLUTIONS
3135 RESEARCH BLVD.
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FAX: 937.254.8305

NO	DATE	BY	GENERAL REVISIONS
5			
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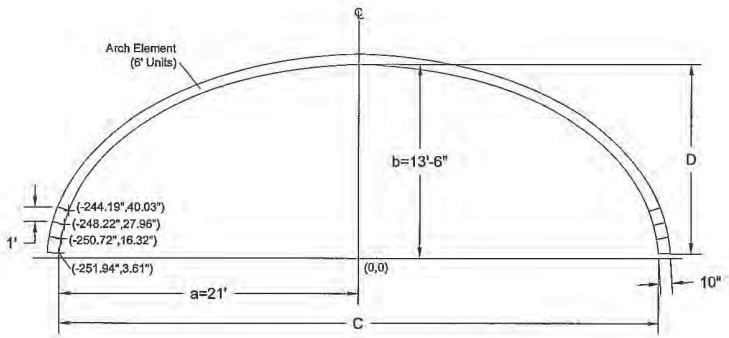
1	6/4/08	JJV	

STANDARD DRAWINGS
KY TRANSPORTATION CABINET
BEBO E-SERIES GEOMETRY

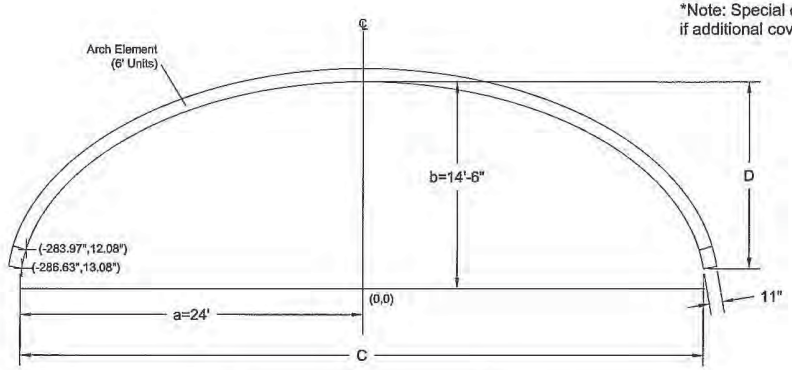
JOB NO.:
SHEET NO.: 3 OF 15

Minimum Cover = 1.5'
Maximum Cover = 15' *

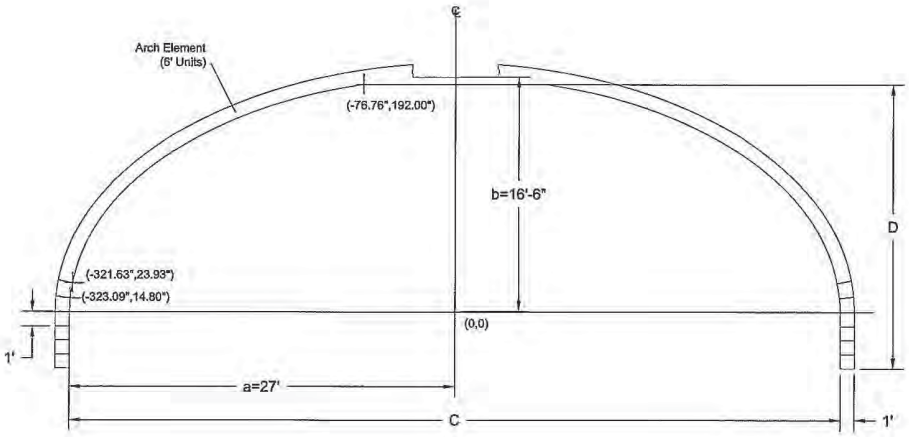
*Note: Special designs are available if additional cover is required.



E42		
Span, C	Rise, D	Waterway Area (Sq. Ft)
40'-8 3/8"	10'-2"	306.7
41'-4 7/16"	11'-2"	347.7
41'-9 7/16"	12'-2"	389.3
41'-11 7/8"	13'-2"	431.2



E48		
Span, C	Rise, D	Waterway Area (Sq. Ft)
47'-3 15/16"	12'-1"	431.0
47'-9 1/4"	13'-1"	478.6



E54T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
53'-7 1/4"	14'-0"	587.6
53'-10 13/16"	15'-0"	641.4
54'-0"	16'-0"	695.3
54'-0"	17'-0"	749.3
54'-0"	18'-0"	803.3
54'-0"	19'-0"	857.3
54'-0"	20'-0"	911.3

Elipse Centered @ (0,0)

$$\left(\frac{X}{a}\right)^2 + \left(\frac{Y}{b}\right)^2 = 1$$

BEBO® Arch Systems

CONTECH BRIDGE SOLUTIONS
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STANDARD DRAWINGS

KY TRANSPORTATION CABINET

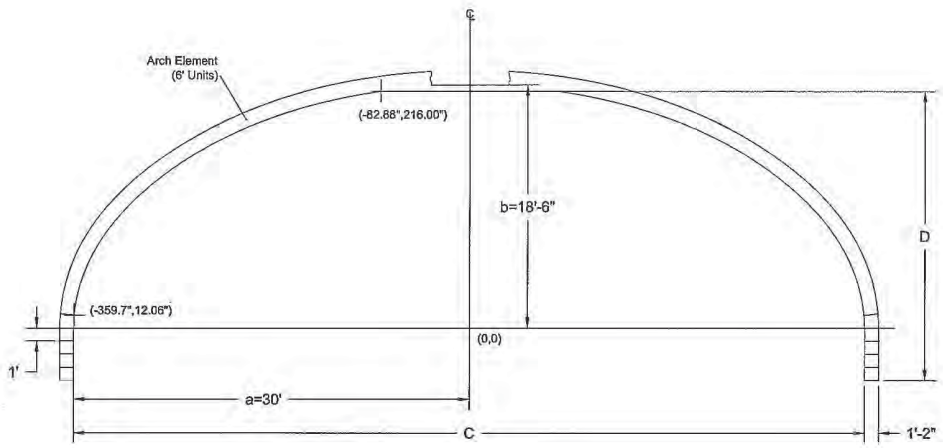
BEBO E-SERIES GEOMETRY

JOB NO:

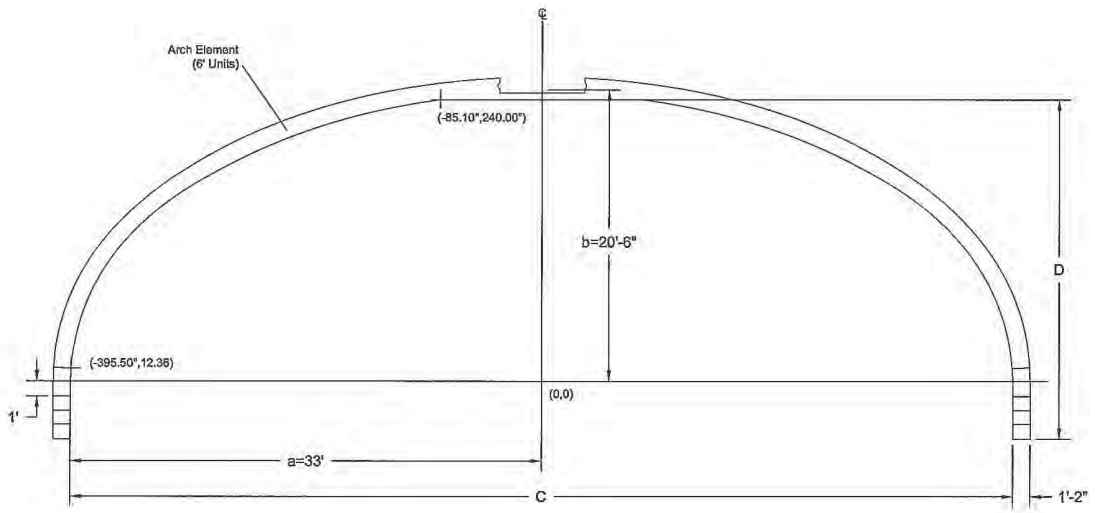
SHEET NO: 4 OF 15

Minimum Cover = 1.5'
Maximum Cover = 15' *

*Note: Special designs are available if additional cover is required.



E60T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
59'-10 15/16"	17'-0"	807.1
60'-0"	18'-0"	867.1
60'-0"	19'-0"	927.2
60'-0"	20'-0"	987.2
60'-0"	21'-0"	1047.1
60'-0"	22'-0"	1107.1



E66T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
65'-11"	19'-0"	991.8
66'-0"	20'-0"	1057.8
66'-0"	21'-0"	1123.8
66'-0"	22'-0"	1189.8
66'-0"	23'-0"	1255.8
66'-0"	24'-0"	1321.8

Elipse Centered @ (0,0)

$$\left(\frac{X}{a}\right)^2 + \left(\frac{Y}{b}\right)^2 = 1$$

BEBO® Arch Systems

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3026 RESEARCH BLVD.
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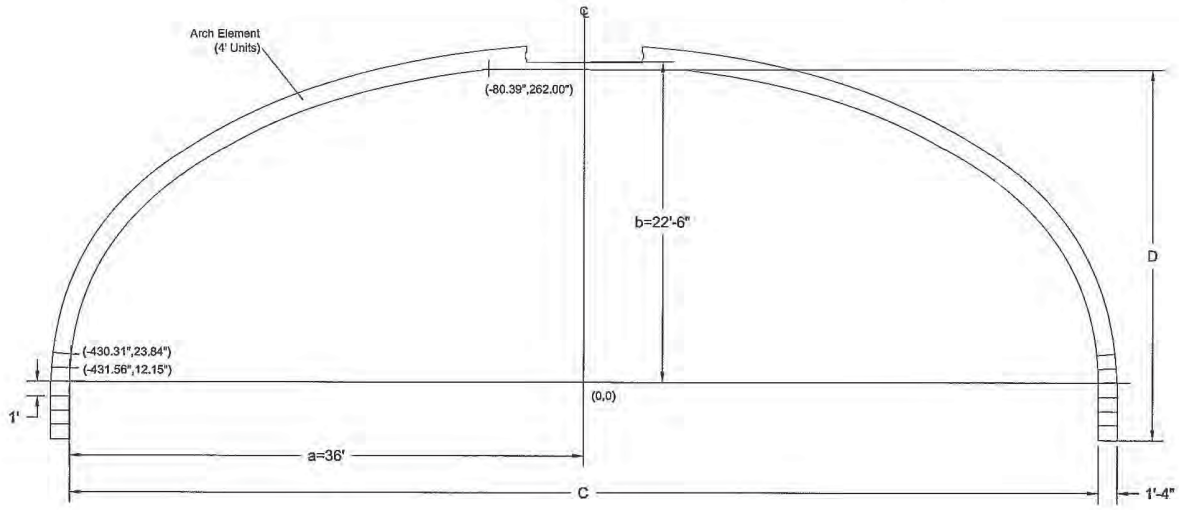
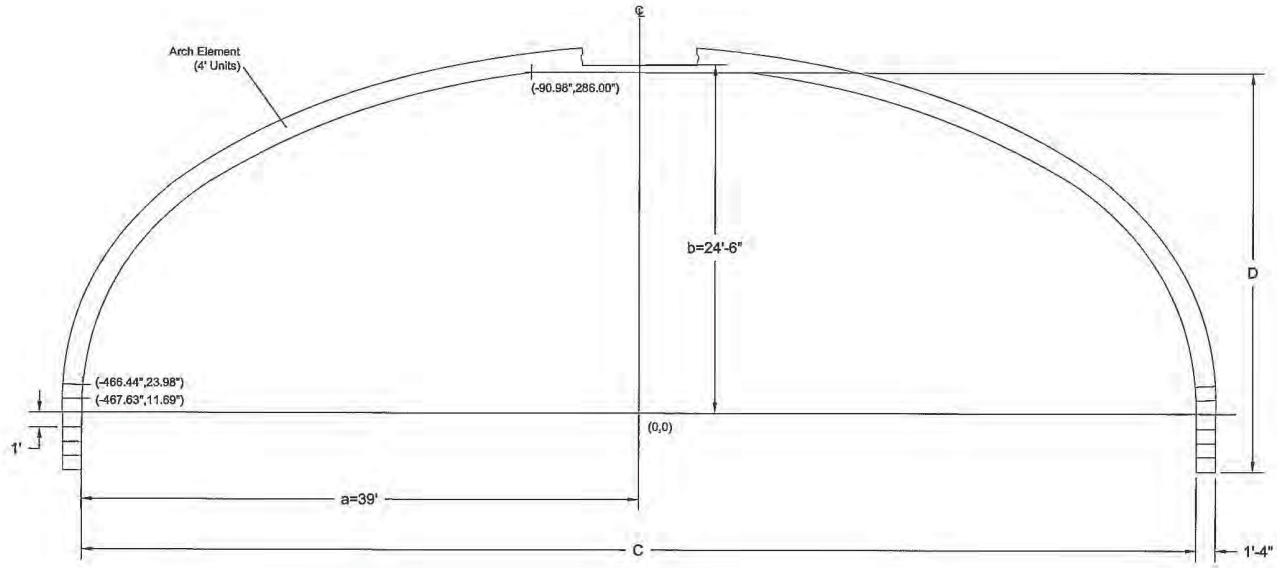
STANDARD DRAWINGS
KY TRANSPORTATION CABINET
BEBO E-SERIES GEOMETRY
JOB NO.:
SHEET NO.: 5 OF 15



Minimum Cover = 1.5'
Maximum Cover = 15' *

*Note: Special designs are available if additional cover is required.

E72T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
71'-8 5/8"	19'-10"	1120.5
71'-11 1/8"	20'-10"	1192.3
72'-0"	21'-10"	1264.3
72'-0"	22'-10"	1336.3
72'-0"	23'-10"	1408.3
72'-0"	24'-10"	1480.3
72'-0"	25'-10"	1552.3



E78T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
77'-8 7/8"	21'-10"	1337.0
77'-11 1/4"	22'-10"	1414.8
78'-0"	23'-10"	1492.8
78'-0"	24'-10"	1570.8
78'-0"	25'-10"	1648.8
78'-0"	26'-10"	1726.8
78'-0"	27'-10"	1804.8

Elipse Centered @ (0,0)

$$\left(\frac{X}{a}\right)^2 + \left(\frac{Y}{b}\right)^2 = 1$$

BEBO® Arch Systems

CONTECH BRIDGE SOLUTIONS INC.
3100 RESEARCH BLVD.
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STANDARD DRAWINGS

KY TRANSPORTATION CABINET

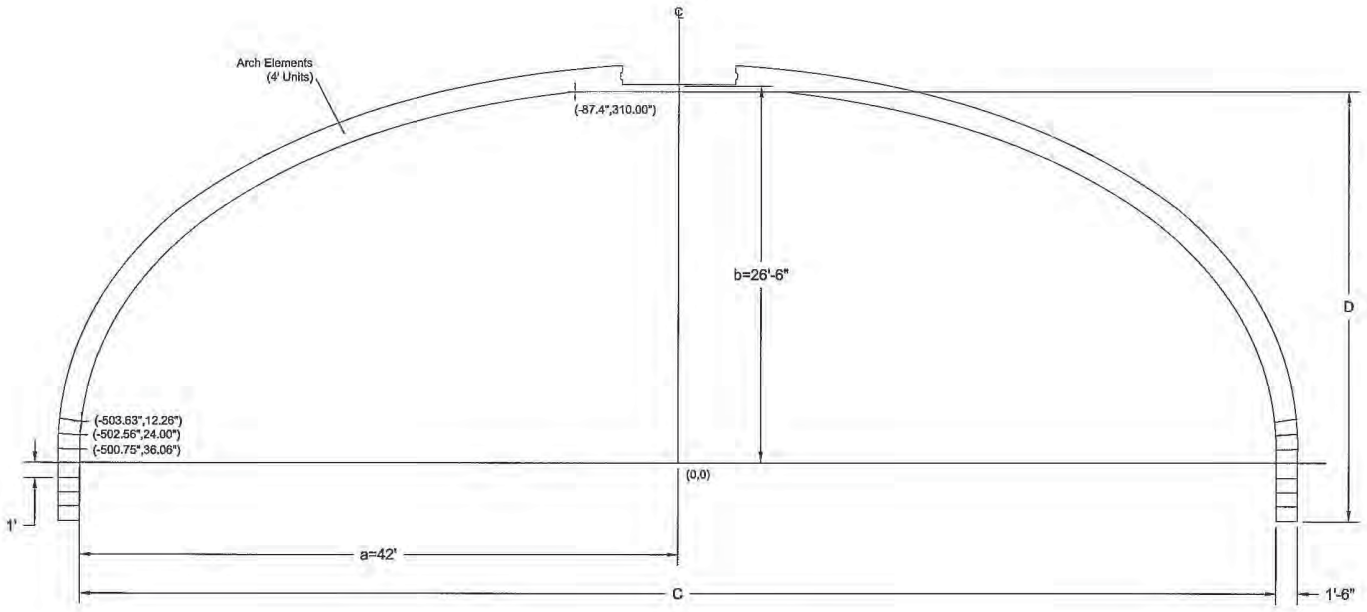
BEBO E-SERIES GEOMETRY

JOB NO:

SHEET NO: 6 OF 15

Minimum Cover = 1.5'
Maximum Cover = 15' *

*Note: Special designs are available if additional cover is required.



E84T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
83'-5 1/2"	22'-10"	1488.5
83'-9 1/8"	23'-10"	1572.1
83'-11 1/4"	24'-10"	1655.9
84'-0"	25'-10"	1739.9
84'-0"	26'-10"	1823.9
84'-0"	27'-10"	1907.9
84'-0"	28'-10"	1991.9
84'-0"	29'-10"	2075.9

Elipse Centered @ (0,0)

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1$$

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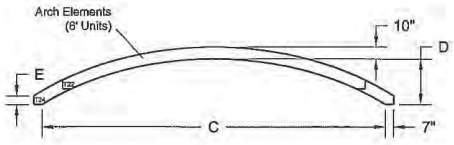
STANDARD DRAWINGS
KY TRANSPORTATION CABINET
BEBO E-SERIES GEOMETRY

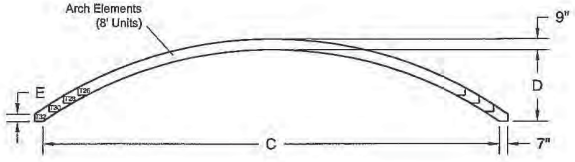
JOB NO.:
SHEET NO.: 7 OF 15

Minimum Cover = 1.5'
Maximum Cover = 6' *

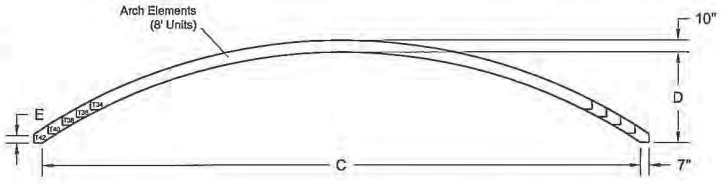
*Note: Special designs are available if additional cover is required.



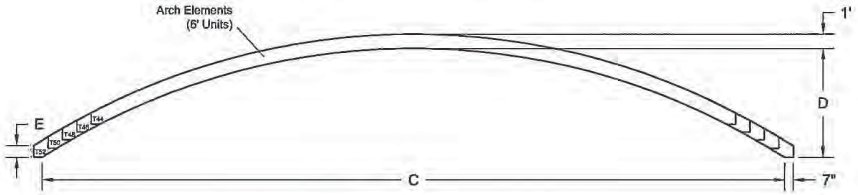
Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T22	22'-0"	2'-7"	7 5/8"	29
T24	24'-0"	3'-2"	7 1/4"	52



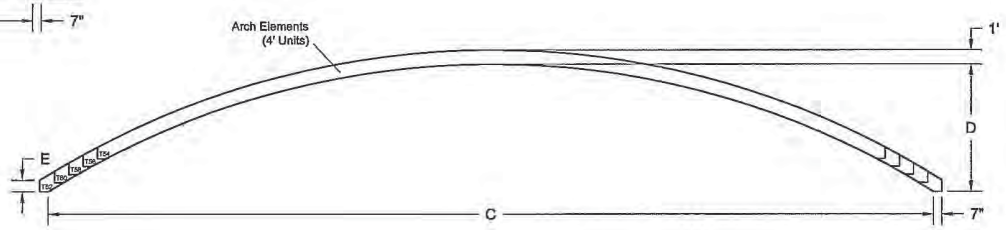
Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T26	26'-0"	3'-2"	6 1/2"	56
T28	28'-0"	3'-9"	6 3/8"	71
T30	30'-0"	4'-4"	6 1/4"	88
T32	32'-0"	5'-0"	6 1/8"	109



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T34	34'-0"	4'-0"	7 5/8"	91
T36	36'-0"	4'-6"	7 5/8"	110
T38	38'-0"	5'-1"	7 1/4"	130
T40	40'-0"	5'-8"	7 3/8"	154
T42	42'-0"	6'-4"	7 3/8"	180



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T44	44'-0"	5'-4"	9 7/8"	158
T46	46'-0"	5'-10"	9 7/8"	181
T48	48'-0"	6'-5"	9 7/8"	208
T50	50'-0"	7'-0"	9 3/4"	237
T52	52'-0"	7'-8"	9 3/4"	269



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T54	54'-0"	6'-8"	9 7/8"	242
T56	56'-0"	7'-2"	9 7/8"	272
T58	58'-0"	7'-9"	9 7/8"	304
T60	60'-0"	8'-4"	9 3/4"	339
T62	62'-0"	9'-0"	9 3/4"	376

BEBO® Arch Systems

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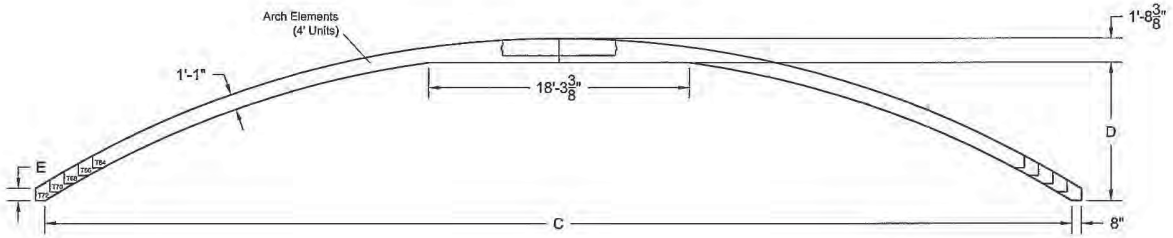
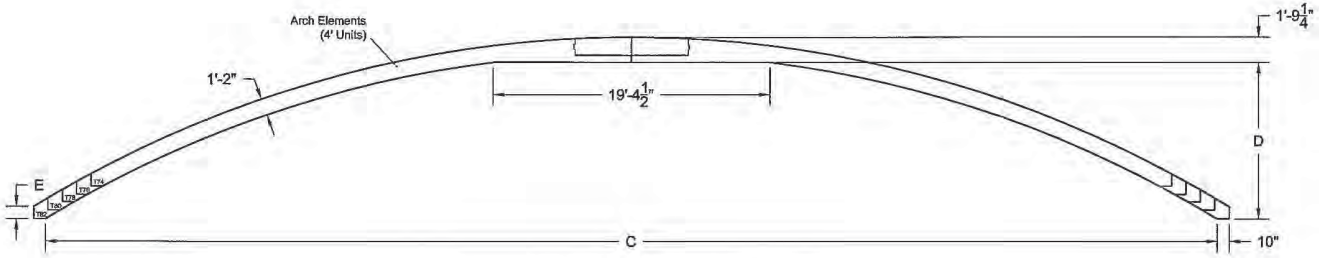
STANDARD DRAWINGS
KY TRANSPORTATION CABINET
BEBO T-SERIES GEOMETRY
JOB NO.:
SHEET NO.: 8 OF 15

Minimum Cover = 1.5'
Maximum Cover = 4' *

*Note: Special designs are available if additional cover is required.



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T64	64'-0"	7'-5"	10 1/2"	338
T66	66'-0"	7'-11"	10 3/8"	374
T68	68'-0"	8'-6"	10 3/8"	411
T70	70'-0"	9'-1"	10 3/8"	452
T72	72'-0"	9'-8 1/2"	10 3/8"	496



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T74	74'-0"	8'-9"	10 1/2"	459
T76	76'-0"	9'-4"	10 7/8"	502
T78	78'-0"	9'-10"	10 3/8"	544
T80	80'-0"	10'-5"	10 3/8"	590
T82	82'-0"	11'-0"	10 1/4"	639

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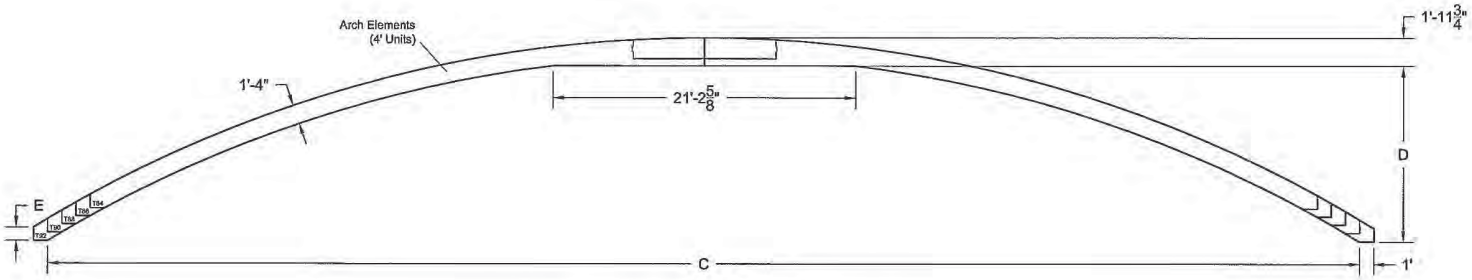
STANDARD DRAWINGS
KY TRANSPORTATION CABINET
BEBO T-SERIES GEOMETRY

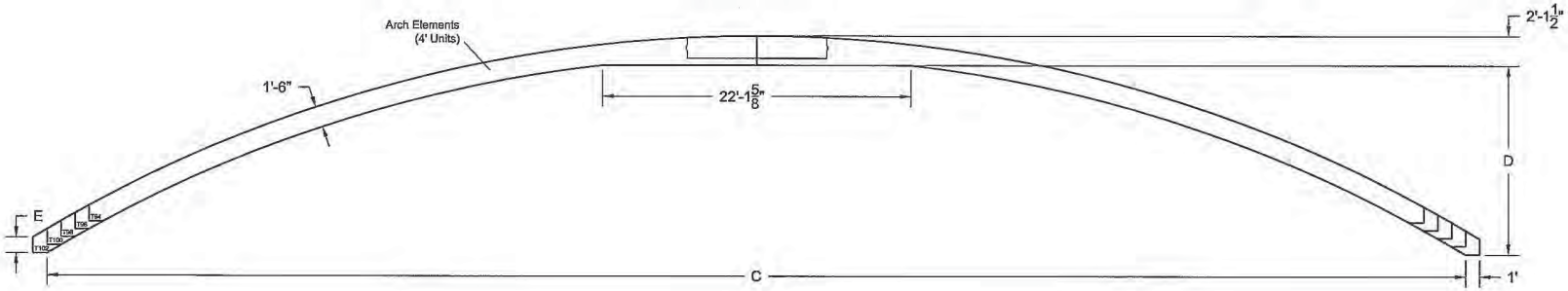
JOB NO:
SHEET NO: 9 OF 15

Minimum Cover = 1.5'
Maximum Cover = 4' *

*Note: Special designs are available if additional cover is required.



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T84	84'-0"	10'-0"	11 5/8"	596
T86	86'-0"	10'-7"	11 5/8"	643
T88	88'-0"	11'-2"	11 1/2"	693
T90	90'-0"	11'-9"	11 1/2"	745
T92	92'-0"	12'-4"	11 3/8"	800



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T94	94'-0"	11'-4"	1'-2"	753
T96	96'-0"	11'-11"	1'-1 7/8"	805
T98	98'-0"	12'-6"	1'-1 7/8"	861
T100	100'-0"	13'-1"	1'-1 3/4"	919
T102	102'-0"	13'-8"	1'-1 3/4"	979

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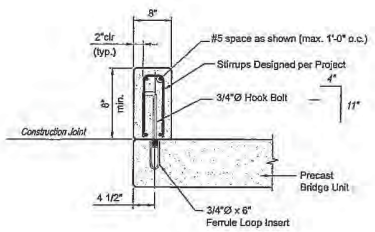
STANDARD DRAWINGS

KY TRANSPORTATION CABINET

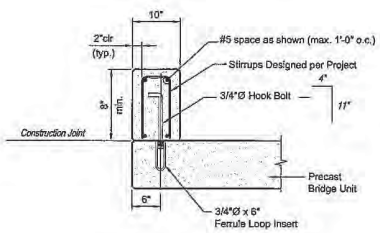
BEBO T-SERIES GEOMETRY

JOB NO.:

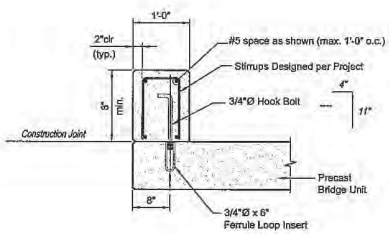
SHEET NO.: 10 OF 15



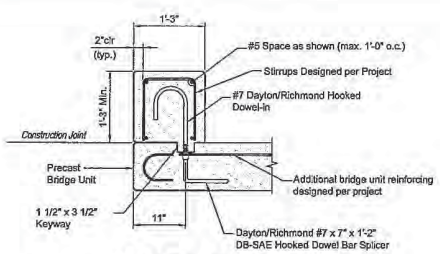
8" ATTACHED HEADWALL



10" ATTACHED HEADWALL



12" ATTACHED HEADWALL

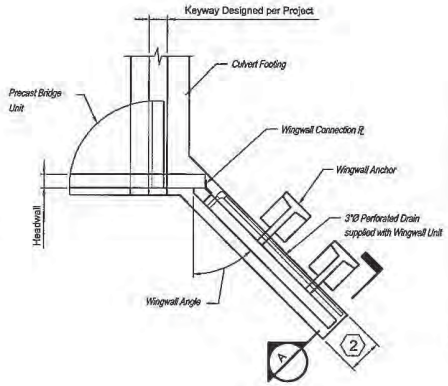


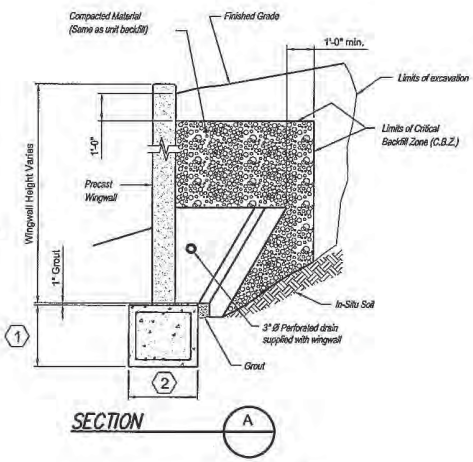
15" ATTACHED HEADWALL FOR GUIDERAIL

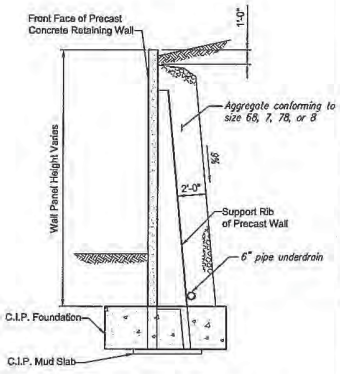
PRECAST WINGWALL DETAILS

NOTES:

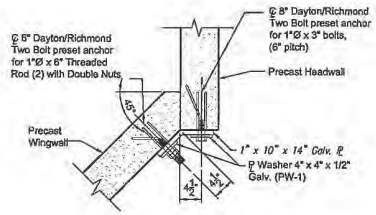
1. Footing depth determined by scour considerations.
2. Wingwall footing width determined by allowable soil bearing.
3. For level installation, top of culvert and wingwall footings at same elevation. For sloping installation, top of footings to be on same plane.
4. Provide bent bars to make culvert and wingwall footing reinforcing continuous.



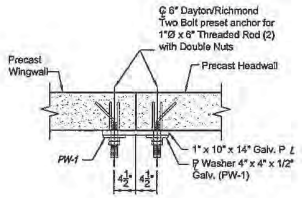




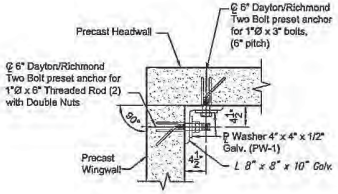
PRECAST MUR EBAL WALL PANEL



45° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL



90° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL



0° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL

Note: Standard wingwall angles are 0, 30, 45, 60, and 90 degrees. Special angles may be fabricated to meet specific site requirements.

BEBO® Arch Systems
CONTECH BRIDGE SOLUTIONS
DIVISION OF CONTECH ENGINEERED SOLUTIONS LLC
9025 CENTRE POINTE DRIVE, SUITE 400
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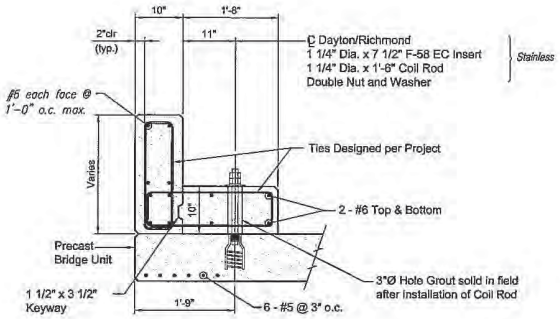
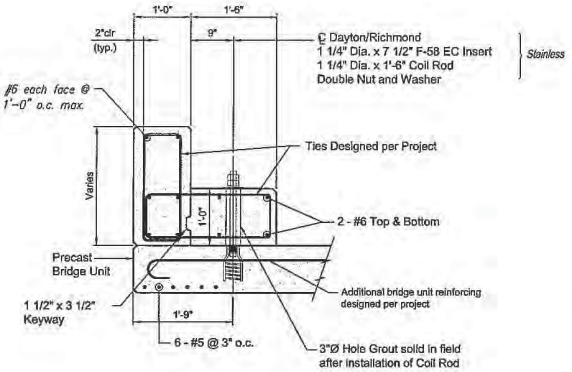
STANDARD DRAWINGS
KY TRANSPORTATION CABINET
HEADWALL & WINGWALL DETAILS
JOB NO.:
SHEET NO.: 11 OF 15



10" DETACHED HEADWALL CONTINUOUS COLLAR



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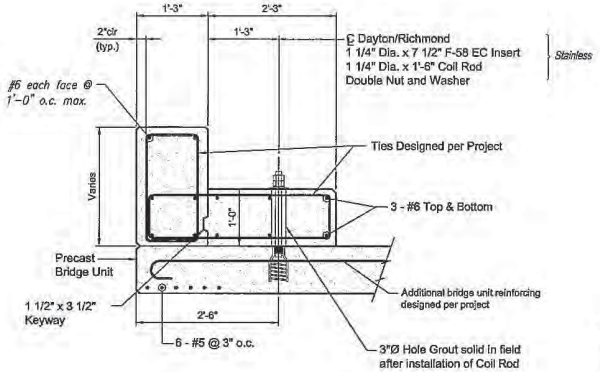
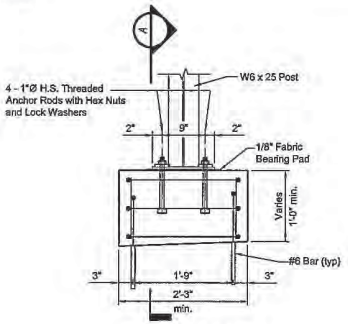


15" DETACHED HEADWALL CONTINUOUS COLLAR - FOR GUIDERAIL



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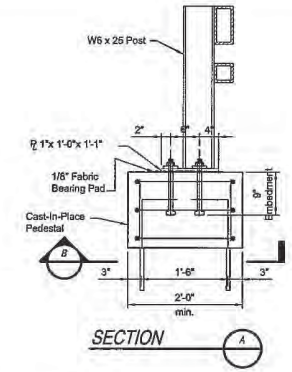
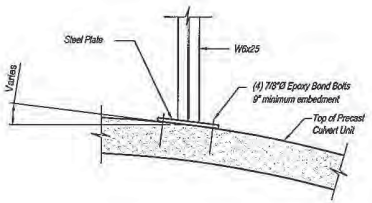
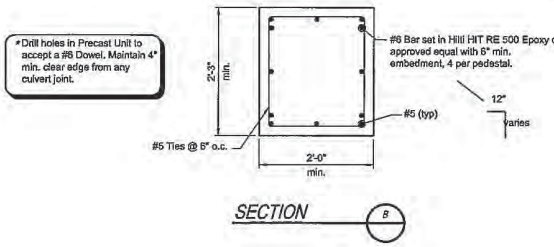


SECTION A





SECTION B

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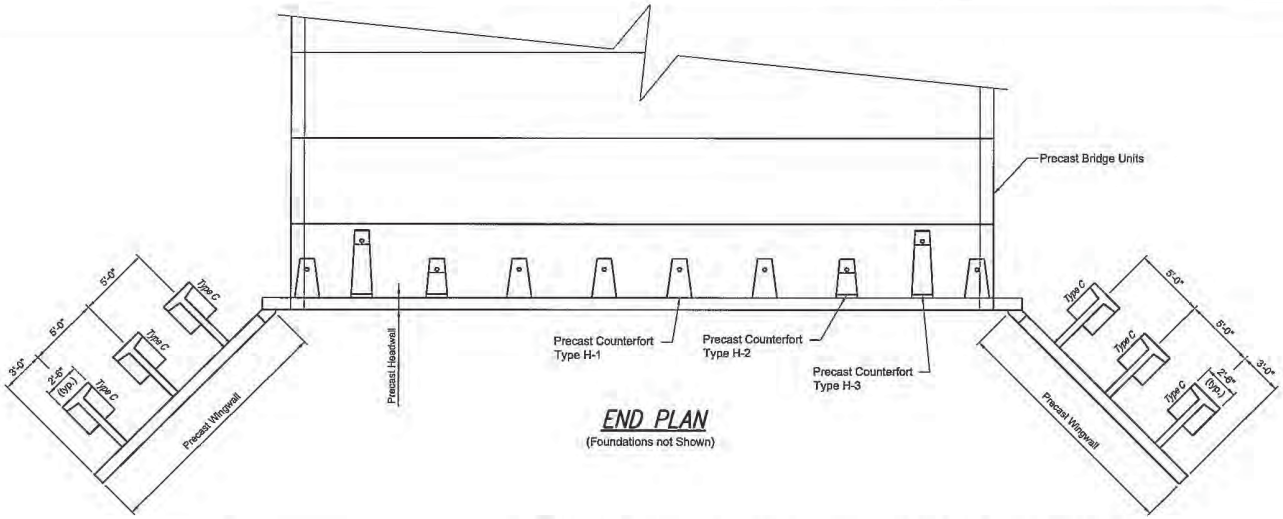
STANDARD DRAWINGS

KY TRANSPORTATION CABINET

HEADWALL & GUIDERAIL DETAILS

JOB NO.:

SHEET NO.: 12 OF 15



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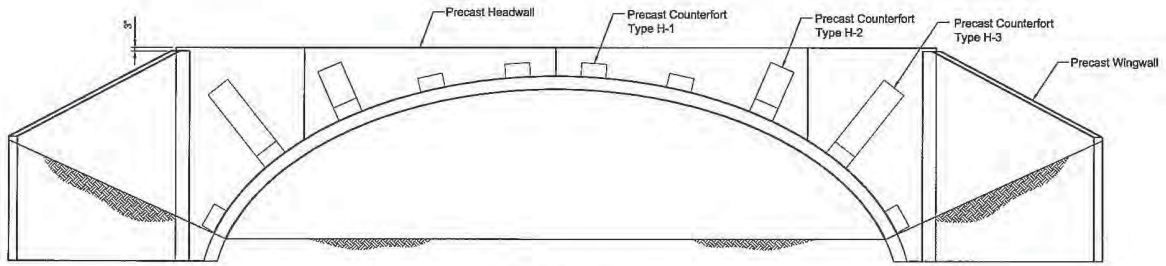

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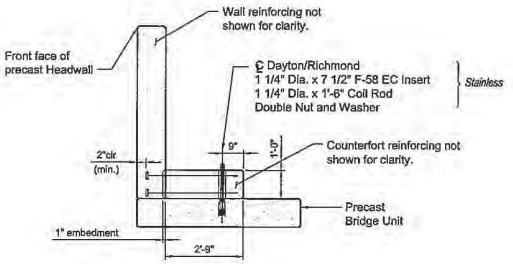
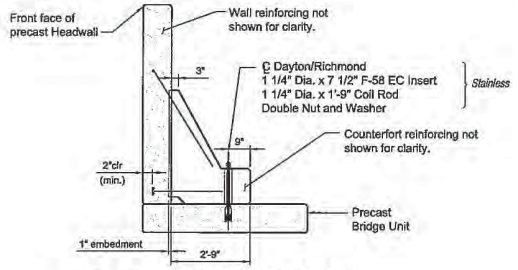


DETACHED HEADWALL COUNTERFORT TYPE H-1



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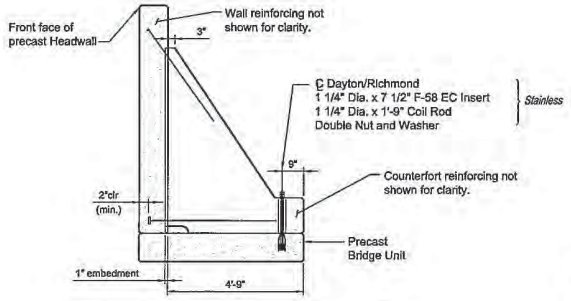

DETACHED HEADWALL COUNTERFORT TYPE H-3

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STANDARD DRAWINGS
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HEADWALL DETAILS

JOB NO.:
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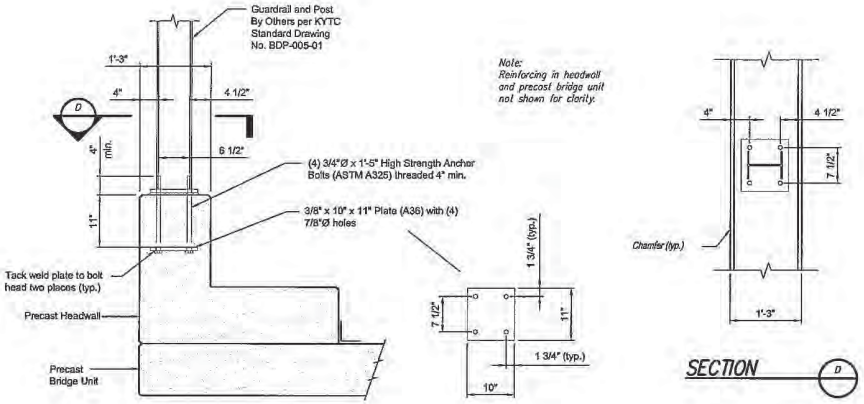
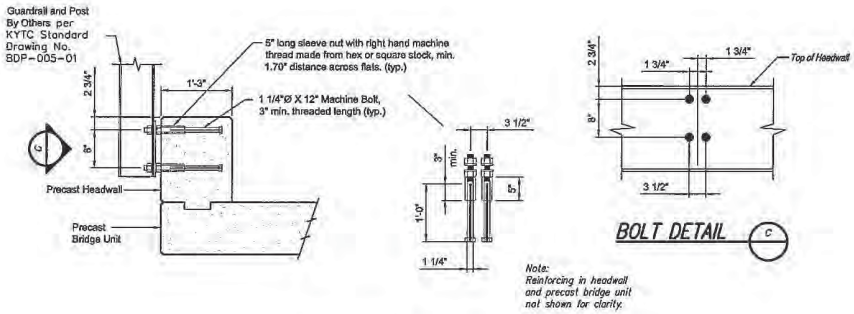


TOP MOUNTED GUARDRAIL CONNECTION



SIDE MOUNTED GUARDRAIL CONNECTION

PRECAST REQUIREMENTS

1 All materials must be in conformance with KYTC Standard Specifications for Road and Bridge Construction, the KYTC List of Approved Materials, and all applicable ASTM and AASHTO standards.

2 All precast components shall be manufactured by a fabricator approved by KYTC and be in strict compliance with Section 605 of the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction.

3 Comply with Section 106.4 of the Standard Specifications for Road and Bridge Construction Buy American Requirement.

4 Precast arch units shall be constructed with one weephole in each leg per KYTC Standard Specifications for Road and Bridge Construction.

5 Precast components shall be designed according to the current version of the AASHTO LRFD Bridge Design Specifications. Arch units shall be designed to support HL-93 Live Load.

CONSTRUCTION REQUIREMENTS

1 Footings - The bridge units and wingwalls shall be installed on either precast or cast-in-place concrete footings. The design size and elevation of the footings shall be as specified on the plans. A keyway shall be formed in the top surface of the bridge footing with depth, width and location as specified on the plans. No keyway is required in the wingwall footings, unless otherwise specified on the plans. The footings shall be given a smooth float finish and shall reach the required compressive strength before placement of the bridge and wingwall elements. The completed footing surface shall be constructed in accordance with grades shown on the plans. When tested with a 10 foot straight edge, the surface shall not vary more than 1/4 inch in 10 feet. If a precast concrete footing is used, the contractor shall prepare a 4 inch thick base layer of compacted granular material the full width of the footing prior to placing the precast footing.

2 Placement of the Bridge Units, Wingwalls and Headwalls - The bridge units, wingwalls and headwalls shall be placed as shown on the Engineer's plan drawings. Special care shall be taken in setting the elements to the true line and grade. The bridge units and wingwalls shall be set on masonite or steel shims or mortar leveling pads. A minimum gap of 1/2 inch shall be provided between the footing and the bottom of the bridge's vertical legs or the wingwall. The gap shall be filled with non-shrink cement grout with a minimum 28-day compressive strength of 5000 psi. If units have been set with temporary ties (cables, bars, etc.) grout must attain a minimum compressive strength of 2500 psi before ties may be removed.

3 External Protection of Joints - The butt joint made by two adjoining bridge units shall be covered with a 7/8" x 1 3/8" preformed bituminous joint sealant and a minimum of a 9 inch wide joint wrap. The surface shall be free of dirt before applying the joint material. A primer compatible with the joint wrap to be used shall be applied for a minimum width of nine inches on each side of the joint. The external wrap shall be either EZ-WRAP RUBBER by PRESS-SEAL GASKET CORPORATION, SEAL WRAP by MAR MAC MANUFACTURING CO. INC. or approved equal. The joint shall be covered continuously from the bottom of one bridge section leg, across the top of the arch and to the opposite bridge section leg. Any laps that result in the joint wrap shall be a minimum of six inches long with the overlap running downhill.

In addition to the joints between bridge units, the joint between the end bridge unit and the headwall shall also be sealed as described above. If precast wingwalls are used, the joint between the end bridge unit and the wingwall shall be sealed with a 2'-0" strip of filter fabric. Also, if lift holes are formed in the arch units, they shall be primed and covered with a 9" x 9" square of joint wrap.

During the backfilling operation, care shall be taken to keep the joint wrap in its proper location over the joint.

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STANDARD DRAWINGS
KY TRANSPORTATION CABINET
GUIDERAIL ATTACHMENT DETAILS

JOB NO: SHEET NO: 14 OF 15

1 BACKFILL REQUIREMENTS FOR BEBO E SERIES AND C SERIES ARCHES

1.1 BACKFILL COMPACTION

1.1.1 MECHANICAL TAMPERS OR APPROVED COMPACTING EQUIPMENT SHALL BE USED TO COMPACT ALL BACKFILL AND EMBANKMENT IMMEDIATELY ADJACENT TO EACH SIDE AND OVER THE TOP OF EACH BRIDGE UNIT UNTIL IT IS COVERED TO A MINIMUM DEPTH OF ONE FOOT, UNLESS THE DESIGN FILL HEIGHT IS LESS THAN 1'-0". THE BACKFILL WITHIN THE CRITICAL BACKFILL ZONE (SHOWN IN THE DIAGRAMS BELOW) SHALL BE PLACED IN LIFTS OF EIGHT INCHES OR LESS (LOOSE DEPTH). HEAVY COMPACTION EQUIPMENT SHALL NOT BE OPERATED IN THIS AREA OR OVER THE BRIDGE UNTIL IT IS COVERED TO A DEPTH OF ONE FOOT, UNLESS THE DESIGN FILL HEIGHT IS LESS THAN 1'-0".

1.1.2 LIGHTWEIGHT DOZERS AND GRADERS MAY BE OPERATED OVER BRIDGE UNITS HAVING ONE FOOT OF COMPACTED COVER, BUT HEAVY EARTH MOVING EQUIPMENT (LARGER THAN A D-4 DOZER WEIGHING IN EXCESS OF 12 TONS AND HAVING TRACK PRESSURES OF EIGHT PSI OR GREATER) SHALL REQUIRE TWO FEET OF COVER UNLESS THE DESIGN COVER IS LESS THAN TWO FEET. IN NO CASE SHALL EQUIPMENT OPERATING IN EXCESS OF THE DESIGN LOAD (HS20 OR HS25) BE PERMITTED OVER THE BRIDGE UNITS UNLESS APPROVED BY CON/SPAN®.

1.1.3 ANY ADDITIONAL FILL AND SUBSEQUENT EXCAVATION REQUIRED TO PROVIDE THIS MINIMUM COVER SHALL BE MADE AT NO ADDITIONAL COST TO THE PROJECT.

1.1.4 AS A PRECAUTION AGAINST INTRODUCING UNBALANCED STRESSES IN THE BRIDGE, WHEN PLACING BACKFILL AT NO TIME SHALL THE DIFFERENCE BETWEEN THE HEIGHTS OF FILL ON OPPOSITE SIDES OF THE BRIDGE EXCEED 24".

1.1.5 BACKFILL IN FRONT OF WINGWALLS SHALL BE CARRIED TO GROUND LINES SHOWN IN THE PLANS.

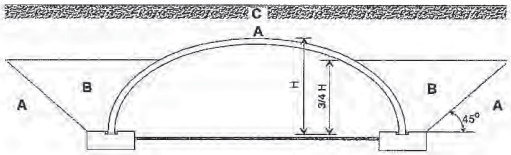
1.1.6 FOR FILL HEIGHTS OVER 12 FEET, NO BACKFILLING MAY BEGIN UNTIL A BACKFILL COMPACTION TESTING PLAN HAS BEEN COORDINATED WITH AND APPROVED BY CON/SPAN® BRIDGE SYSTEMS. COST OF THE BACKFILL COMPACTION TESTING SHALL BE INCLUDED IN THE COST OF THE PRECAST UNITS. THIS INCLUDED COST APPLIES ONLY TO PROJECTS WITH FILL HEIGHTS OVER 12 FEET (AS MEASURED FROM TOP CROWN OF ARCH TO FINISHED GRADE).

TYPICAL USCS MATERIALS	Group	Sub-Group	Per Cent Passing U.S. Sieve No.			Character of Fraction Passing No. 40 Sieve		Group Index No.	Soil Description
			10 (2mm)	40 (0.4mm)	200 (0.074mm)	Liquid Limit	Plasticity Index		
GW, GP, SP	A-1			50 max.	25 max.		6 max.	0	Well-graded gravel or sand; may include fines
GM, SW, SP, SM		A-1-a	50 max.	30 max.	15 max.		6 max.	0	Largely gravel but can include sand and fines
		A-1-b		50 max.	25 max.		6 max.	0	Gravelly sand or graded sand; may include fines
GM, SM, ML, SP, CP	A-2				35 max.			0 to 4	Sands and gravels with excessive fines
SC, GC, GM		A-2-4			35 max.	40 max.	10 max.	0	Sands, gravels with low-plasticity silt fines
GC, GC		A-2-5			35 max.	41 min.	10 max.	0	Granular gravels when plastic silt fines
SC, GC		A-2-6			35 max.	40 max.	11 min.	4 max.	Granular gravels with clay fines
		A-2-7			35 max.	41 min.	11 min.	4 max.	Granular gravels with highly plastic clay fines
SP,SM,SW	A-3			51 min.	10 max.		Nonplastic	0	Fine sands
ML, SM, SC	A-4				36 min.	40 max.	10 max.	0 max.	Low-compressibility silts
ML,OH,MH,CL	A-5				36 min.	41 min.	≥10 max.	≥12 max.	High-compressibility silts
CL,ML,OL	A-6				36 min.	40 max.	11 min.	10 max.	Low-to-medium-compressibility clays
OL, CH, MH, OH, CE,ML	A-7	A-7-5			36 min.	41 min.	11 min.	≥20 max.	High-compressibility clays
OL, CH, MH, OH, CE,ML		A-7-6			36 min.	41 min.	11 min.	≥20 max.	High-compressibility very clays
PT,OH	A-8								Peat, highly organic soils

Acceptable Soils | Non-acceptable Soils

1.2 BACKFILL ZONES

1.2.1 ZONE A: EXISTING SOIL, CONSTRUCTED EMBANKMENT OR OVERFILL.
1.2.2 ZONE B: FILL WHICH IS DIRECTLY ASSOCIATED WITH PRECAST CONCRETE ARCH INSTALLATION.
1.2.3 ZONE C: ROAD STRUCTURE.



1.3 REQUIRED FILL PROPERTIES

1.3.1 ZONE A

1.3.1.1 ZONE A REQUIRES NATURAL GROUND OR FILL MATERIAL WITH SPECIFICATIONS AND FILLING AS WELL AS COMPACTING PROCEDURES EQUAL TO THAT FOR NORMAL ROAD EMBANKMENTS.

1.3.1.2 NATURAL GROUND IS TO BE SUFFICIENTLY STABLE TO ALLOW EFFECTIVE SUPPORT TO THE PRECAST CONCRETE ARCH UNITS. AS A GUIDE, THE EXISTING NATURAL GROUND SHOULD BE OF SIMILAR QUALITY AND DENSITY TO ZONE B MATERIAL FOR A MINIMUM LATERAL DIMENSION OF ONE ARCH SPAN OUTSIDE OF THE ARCH FOOTING.

1.3.2 ZONE B

1.3.2.1 GENERALLY, SOILS THAT MEET THE FOLLOWING BASIC REQUIREMENTS ARE ACCEPTABLE:
- Φ' ≥ 30° ANGLE OF INTERNAL (COMPACTED STATE)FRICTION, IN
- WL ≤ 40% (LIQUID LIMIT)
- IP ≤ 10% (PLASTICITY INDEX)

1.3.2.2 SOILS SHALL BE REASONABLY FREE OF ORGANIC MATTER, AND, NEAR CONCRETE SURFACES, FREE OF STONES LARGER THAN 3 INCHES IN DIAMETER.

1.3.2.3 MATERIALS WITH GRADATIONS THAT FALL WITHIN THE FOLLOWING LIMITS (SHADED AREA OF FIGURE C2), NORMALLY FULFILL THE ABOVE BASIC REQUIREMENTS:

SOILS SHOULD HAVE A WATER CONTENT THAT ALLOWS TO OBTAIN THE REQUIRED COMPACTION. THIS IS ESPECIALLY CRITICAL FOR SOILS OF THE USCS GROUPS SM-ML AND SM-SC.
SOILS THAT EXCEED THE GRADATION LIMITS AT THE OPENINGS ≤ 0.020 MM (SILT/CLAY FRACTION) OF THE USCS GROUPS GC-CL, SC-CL, ML AND CL-ML CAN STILL BE ACCEPTABLE, BUT NEED TO BE LABORATORY TESTED FOR THE ABOVE BASIC REQUIREMENTS.
THE FOLLOWING USCS SOIL GROUPS ARE NOT ACCEPTABLE AS BACKFILL MATERIAL IN THEIR NATURAL STATE:

GC-CH	(GRAVEL WITH HIGH PLASTICITY CLAY)
SC-CH	(SAND WITH HIGH PLASTICITY CLAY)
CL	(GRAVELLY AND/OR SANDY, CLAYEY SILT)
OL	(GRAVELLY AND/OR SANDY, ORGANIC SILT)
CH	(GRAVELLY AND/OR SANDY, SILTY CLAY)
OH	(GRAVELLY AND/OR SANDY ORGANIC SILTY CLAY)
MH	(GRAVELLY AND/OR SANDY HIGH PLASTICITY SILT)

MATERIAL OF THE SOIL GROUPS GC-CH AND SC-CH CAN BE IMPROVED ("SOIL CEMENT") BY ADDING CEMENT OR LIME AND USED FOR BACKFILLING. HOWEVER, SPECIAL KNOW-HOW AND TESTING WILL BE NECESSARY.
THE SUITABILITY OF BACKFILL MATERIAL CAN ALSO BE DETERMINED USING AASHTO DESIGNATION M 145-87. IN GENERAL, SOILS GROUPS A-1, A-2, A-3 AND A-4 ARE ACCEPTABLE (SEE TABLE BELOW, BUREAU OF PUBLIC ROADS CLASSIFICATION).

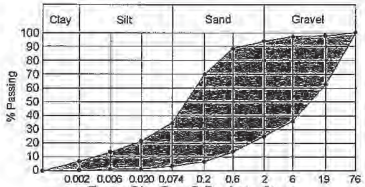


Figure C2: Zone B Gradation Limits

1) DETERMINATION OF GROUP INDEX NO.
GROUP INDEX = (F - 35) · (0.2 + 0.005 · (LL - 40)) + 0.01 · (F - 15) · (PI - 10)
IN WHICH F = PERCENTAGE PASSING NO. 200 (0.074 MM) SIEVE, EXPRESSED AS A WHOLE NUMBER, THIS PERCENTAGE IS BASED ONLY ON THE MATERIAL PASSING THE 3-IN (75 MM) SIEVE.
LL = LIQUID LIMIT
PI = PLASTICITY INDEX
- INDEX NO. 0 - 4 INDICATES A "GOOD" MATERIAL
- INDEX NO. 5 - 14 INDICATES A "FAIR" MATERIAL
- INDEX NO. 15 - 19 INDICATES A "POOR" MATERIAL
- INDEX NO. 20 OR GREATER INDICATES A "VERY POOR" MATERIAL

THE NECESSARY FILL PROPERTIES FOR ZONE B CAN ALSO BE ACHIEVED BY THE USE OF CONTROLLED LOW-STRENGTH MATERIALS (FLOWABLE/SELF-COMPACTING FILL). THIS CAN BE PARTICULARLY BENEFICIAL IN RESTRICTED CONDITIONS (NARROW EXCAVATIONS) WHERE COMPACTING IS DIFFICULT AND/OR WHEN PLACEMENT OF BACKFILL IS TIME-CONSUMING (MULTIPLE-SPAN STRUCTURES). COMPRESSIVE STRENGTHS OF THIS CLSM OF 100 PSI (0.7 N/MM2) OR EVEN LESS ARE APPROPRIATE.

1.3.3 ZONE C

1.3.3.1 ZONE C IS THE ROAD SECTION OF GRAVEL, ASPHALT OR CONCRETE BUILT IN COMPLIANCE WITH LOCAL ENGINEERING PRACTICES. MINIMUM OVERFILL HEIGHT IS ONE FOOT AND A HALF OVER THE CROWN OF THE ARCH, INCLUDING THE PAVEMENT. THERE SHOULD BE AT LEAST 4 INCHES OF SELECT FILL BETWEEN THE ARCH EXTRADOS AND THE BOTTOM OF THE PAVEMENT.

1.3.3.2 PRIOR TO SHIPPING THE PRECAST ARCH ELEMENTS, THE CONTRACTOR SHALL SUPPLY A CERTIFICATION LETTER BY A LICENSED SOILS TESTING FIRM OR REPRESENTATIVE STATING THAT THE BACKFILL SOIL MEETS THE REQUIREMENTS OF SECTION 3.11 B, NUMBER 1 AND 2 ABOVE.

1.4 PLACING AND COMPACTING OF FILL

1.4.1 UNLESS OTHERWISE SPECIFIED, BACKFILLING OPERATIONS SHOULD NOT BEGIN UNTIL THE GROUT OF THE ARCH KEY HAS BEEN IN PLACE FOR 72 HOURS.

1.4.2 DUMPING FOR BACKFILLING IS NOT ALLOWED ANY NEARER THAN 3 FT TO A VERTICAL PLANE THROUGH THE ARCH KEY.

1.4.3 THE FILL MUST BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING ONE FOOT. THE MAXIMUM DIFFERENCE IN THE SURFACE LEVELS OF THE FILL ON OPPOSITE SIDES OF THE ARCH MUST NOT EXCEED 2 FEET.

1.4.4 THE FILL BEHIND WINGWALLS MUST BE PLACED AT THE SAME TIME AS THAT OF THE ARCH FILL. IT MUST BE PLACED IN PROGRESSIVELY PLACED HORIZONTAL LAYERS NOT EXCEEDING ONE FOOT PER LAYER.

1.4.5 THE BACKFILL OF ZONE B MUST BE COMPACTED TO A MINIMUM DENSITY OF 95 % AS REQUIRED BY AASHTO T-99.

1.4.6 SOIL WITHIN 1 FOOT OF CONCRETE SURFACES SHOULD BE HAND-COMPACTED. ELSEWHERE, USE OF ROLLERS IS ACCEPTABLE. IF VIBRATING ROLLER-COMPACTORS ARE USED, THEY SHOULD NOT BE STARTED OR STOPPED WITHIN ZONE B AND THE VIBRATION FREQUENCY SHOULD BE AT LEAST 30 REVOLUTIONS PER SECOND.

1.4.7 THE BACKFILL MATERIAL AND COMPACTING BEHIND WINGWALLS SHOULD SATISFY THE CRITERIA FOR CONSPAN WINGWALL BACKFILL REQUIREMENTS.

1.5 SETTLEMENTS AND HORIZONTAL DISPLACEMENTS

1.5.1 THE CONTRACTOR SHALL CHECK SETTLEMENTS AND HORIZONTAL DISPLACEMENT OF FOUNDATION TO ENSURE THAT THEY ARE WITHIN THE ALLOWABLE LIMIT PROVIDED BY THE ENGINEER. THESE MEASUREMENTS SHOULD GIVE AN INDICATION OF THE SETTLEMENTS AND DEFORMATIONS ALONG THE LENGTH OF THE FOUNDATIONS.

1.5.2 THE FIRST MEASUREMENT ROW SHOULD TAKE PLACE AFTER THE ERECTION OF ALL PRECAST ARCH SYSTEM ELEMENTS, A SECOND AFTER COMPLETION OF BACKFILLING, AND A THIRD BEFORE OPENING OF THE BRIDGE TO TRAFFIC. FURTHER MEASUREMENTS CAN BE MADE ACCORDING TO LOCAL CONDITIONS.

1.5.3 THE MAXIMUM DIFFERENCE IN VERTICAL DISPLACEMENTS 'V' SHOULD NOT EXCEED 1 INCH ALONG THE LENGTH OF ONE FOUNDATION.

1.5.4 IN CONJUNCTION WITH POSSIBLE DISPLACEMENTS OF THE FOUNDATIONS, CHECK FOR VISIBLE CRACKS IN THE CONCRETE OF THE ARCH INTRA DOS. FINE OR HAIRLINE CRACKS ARE TO BE EXPECTED IN THE CROWN AREA AND ARE NOT HARMFUL.

1.6 MEASUREMENT AND PAYMENT

1.6.1 PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL LABOR, MATERIAL, AND EQUIPMENT TO INSTALL THE PRECAST CONCRETE ARCH SYSTEM AND ALL ITS COMPONENTS, FOOTINGS, BACKFILL, ROADWAY AND CLEAN UP.

1.6.2 THE PRECAST CONCRETE ARCH SYSTEM SHALL BE PAID FOR ON A LUMP SUM BASIS.

2 BACKFILL REQUIREMENTS FOR BEBO T SERIES ARCHES

2.1 REQUIRED FILL PROPERTIES

2.1.1 OVERFILL

2.1.1.1 THE OVERFILL AND THE ROAD SECTION OF GRAVEL, ASPHALT OR CONCRETE SHALL BE BUILT IN COMPLIANCE WITH LOCAL ENGINEERING PRACTICES. MINIMUM OVERFILL HEIGHT IS 6 INCHES OVER THE CROWN OF THE ARCH, INCLUDING THE PAVEMENT. THERE SHOULD BE AT LEAST 4 INCHES OF SELECT FILL BETWEEN THE ARCH EXTRADOS AND THE BOTTOM OF THE PAVEMENT.

2.2 PLACING AND COMPACTING OF FILL

2.2.1 UNLESS OTHERWISE SPECIFIED, OVERFILLING OPERATIONS SHOULD NOT BEGIN UNTIL THE CONCRETE OF THE BEBO ARCH FOOTINGS AND THE GROUT AROUND THE TRANSVERSE DOWEL RODS HAVE BEEN IN PLACE FOR 72 HOURS.

2.2.2 DUMPING FOR BACKFILLING IS NOT ALLOWED ANY NEARER THAN 3 FT TO A VERTICAL PLANE THROUGH THE ARCH SPRING.

2.2.3 THE FILL MUST BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING ONE FOOT. THE MAXIMUM DIFFERENCE IN THE SURFACE LEVELS OF THE FILL ON OPPOSITE SIDES OF THE ARCH MUST NOT EXCEED 2 FEET. LINES ARE PAINTED AND NUMBERED ON ARCH ELEMENTS TO INDICATE EACH BACKFILL LEVEL. THIS SERVES AS A GUIDE FOR EQUIPMENT OPERATORS AND HELPS TO ENSURE THAT THE MAXIMUM DIFFERENCE IS NOT EXCEEDED.

2.2.4 THE FILL BEHIND WINGWALLS MUST BE PLACED AT THE SAME TIME AS THAT OF THE ARCH FILL. IT MUST BE PLACED IN PROGRESSIVELY PLACED HORIZONTAL LAYERS NOT EXCEEDING ONE FOOT PER LAYER AND SHALL MEET THE SPECIFICATIONS UNDER ATTACHMENT A HEREIN.

2.2.5 THE OVERFILL MUST BE COMPACTED TO A MINIMUM DENSITY OF 95 % AS REQUIRED BY AASHTO T-99.

2.2.6 SOIL WITHIN 1 FOOT OF CONCRETE SURFACES SHOULD BE HAND-COMPACTED. ELSEWHERE, USE OF ROLLERS IS ACCEPTABLE. IF VIBRATING ROLLER-COMPACTORS ARE USED, THEY SHOULD NOT BE STARTED OR STOPPED WITHIN 3 FT TO A VERTICAL PLANE THROUGH THE ARCH SPRINGS AND THE VIBRATION FREQUENCY SHOULD BE AT LEAST 30 REVOLUTIONS PER SECOND.

2.2.7 THERE ARE NO SPECIAL REQUIREMENTS FOR THE BACKFILL MATERIAL AND COMPACTING BEHIND WINGWALLS EXCEPT THAT EACH SHOULD SATISFY THE CRITERIA FOR NORMAL ROAD EMBANKMENTS.

2.3 SETTLEMENTS AND HORIZONTAL DISPLACEMENTS

2.3.1 THE CONTRACTOR SHALL CHECK SETTLEMENTS AND HORIZONTAL DISPLACEMENT OF FOUNDATION TO ENSURE THAT THEY ARE WITHIN THE ALLOWABLE LIMIT PROVIDED BY THE ENGINEER. THESE MEASUREMENTS SHOULD GIVE AN INDICATION OF THE SETTLEMENTS AND DEFORMATIONS ALONG THE LENGTH OF THE FOUNDATIONS.

2.3.2 THE FIRST MEASUREMENT ROW SHOULD TAKE PLACE AFTER THE ERECTION OF ALL BEBO PRECAST ARCH SYSTEM ELEMENTS, A SECOND AFTER COMPLETION OF BACKFILLING, AND A THIRD BEFORE OPENING OF THE BRIDGE TO TRAFFIC. FURTHER MEASUREMENTS CAN BE MADE ACCORDING TO LOCAL CONDITIONS.

2.3.3 THE MAXIMUM DIFFERENCE IN VERTICAL DISPLACEMENTS 'V' SHOULD NOT EXCEED 1 INCH ALONG THE LENGTH OF ONE FOUNDATION.

2.3.4 IN CONJUNCTION WITH POSSIBLE DISPLACEMENTS OF THE FOUNDATIONS, CHECK FOR VISIBLE CRACKS IN THE CONCRETE OF THE ARCH INTRADOS. FINE OR HAIRLINE CRACK S ARE TO BE EXPECTED IN THE CROWN AREA AND ARE NOT HARMFUL.

2.4 MEASUREMENT AND PAYMENT

2.4.1 PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL LABOR, MATERIAL, AND EQUIPMENT TO INSTALL THE BEBO ARCH SYSTEM AND ALL ITS COMPONENTS, FOOTINGS, ABUTMENTS, BACKFILL, ROADWAY AND CLEAN UP.

2.4.2 THE BEBO-TOP PRECAST ARCH OVERFILLED SYSTEM SHALL BE PAID FOR ON A LUMP SUM BASIS.

BEBO® Arch Systems

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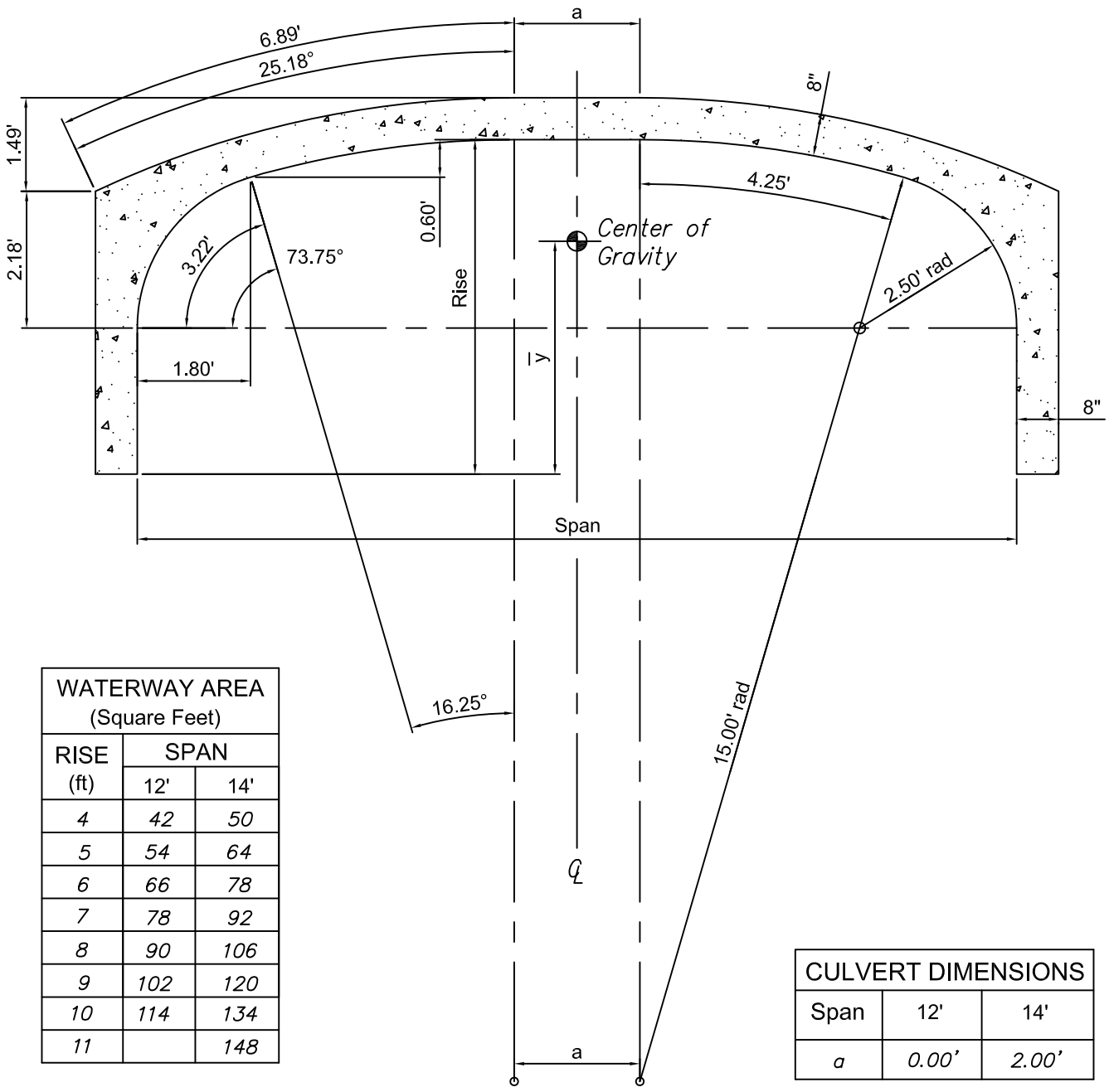
NO.	DATE:	BY:	
6			
5			
4			
3			
2			
1	8/06/04	JJV	GENERAL REVISIONS

STANDARD DRAWINGS
KY TRANSPORTATION CABINET
BACKFILL SPECIFICATIONS

JOB NO.: | SHEET NO.: 15 OF 15

CONSPAN ARCH SYSTEM DRAWINGS AND DETAILS



WATERWAY AREA (Square Feet)		
RISE (ft)	SPAN	
	12'	14'
4	42	50
5	54	64
6	66	78
7	78	92
8	90	106
9	102	120
10	114	134
11		148

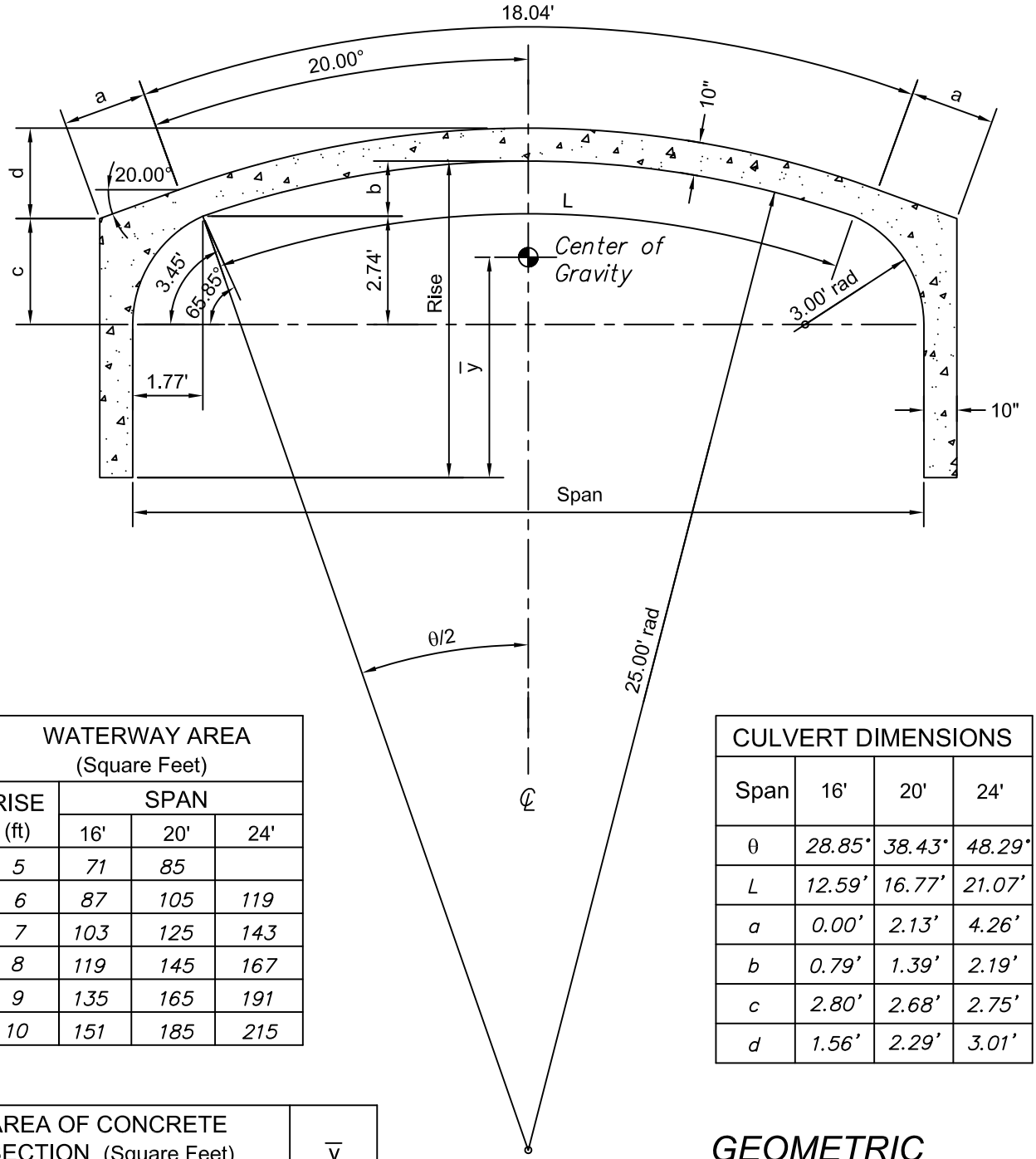
CULVERT DIMENSIONS		
Span	12'	14'
a	0.00'	2.00'

AREA OF CONCRETE SECTION (Square Feet)			$\bar{y}$ (ft)
RISE (ft)	SPAN		
	12'	14'	
4	13.8	15.2	3.2
5	15.2	16.5	3.9
6	16.5	17.8	4.5
7	17.8	19.1	5.1
8	19.2	20.4	5.8
9	20.5	21.7	6.4
10	21.8	23.0	7.0
11		24.3	7.6

MAXIMUM UNIT LENGTH = 8'-0"

GEOMETRIC PROPERTIES 12' and 14' SPANS

CON/SPAN® BRIDGE SYSTEMS



WATERWAY AREA (Square Feet)			
RISE (ft)	SPAN		
	16'	20'	24'
5	71	85	
6	87	105	119
7	103	125	143
8	119	145	167
9	135	165	191
10	151	185	215

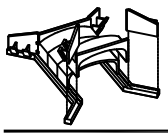
CULVERT DIMENSIONS			
Span	16'	20'	24'
θ	28.85°	38.43°	48.29°
L	12.59'	16.77'	21.07'
a	0.00'	2.13'	4.26'
b	0.79'	1.39'	2.19'
c	2.80'	2.68'	2.75'
d	1.56'	2.29'	3.01'

AREA OF CONCRETE SECTION (Square Feet)				$\bar{y}$ (ft)
RISE (ft)	SPAN			
	16'	20'	24'	
5	22.8	24.8		3.8
6	24.4	26.5	29.1	4.6
7	26.1	28.2	30.8	5.3
8	27.8	29.9	32.5	6.0
9	29.5	31.5	34.2	6.6
10	31.2	33.2	35.8	7.3

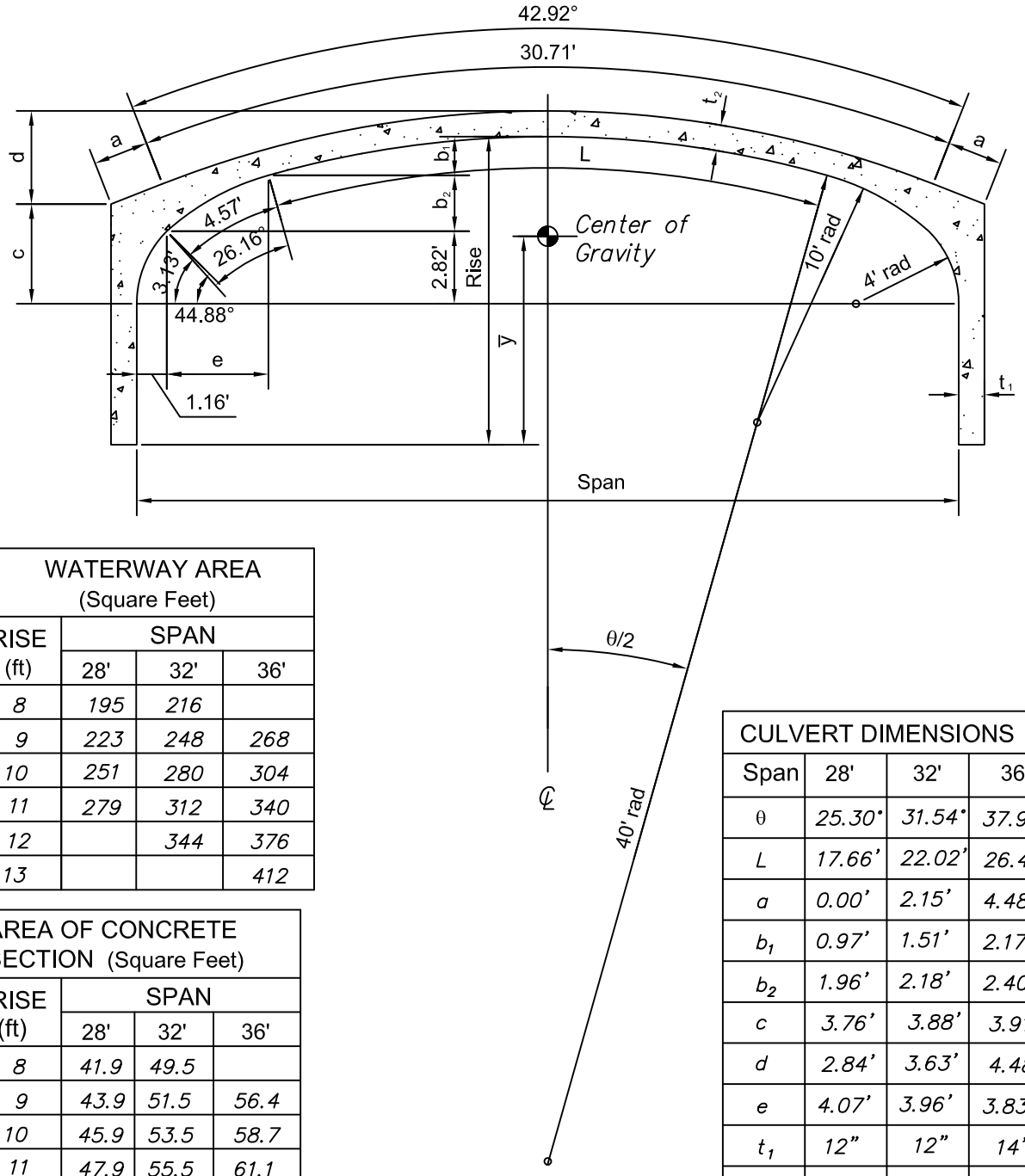
MAXIMUM UNIT LENGTH = 8'-0"

GEOMETRIC PROPERTIES MID-SPAN SERIES

FORM SYSTEM A



CON/SPAN® BRIDGE SYSTEMS



WATERWAY AREA (Square Feet)			
RISE (ft)	SPAN		
	28'	32'	36'
8	195	216	
9	223	248	268
10	251	280	304
11	279	312	340
12		344	376
13			412

AREA OF CONCRETE SECTION (Square Feet)			
RISE (ft)	SPAN		
	28'	32'	36'
8	41.9	49.5	
9	43.9	51.5	56.4
10	45.9	53.5	58.7
11	47.9	55.5	61.1
12		57.5	63.4
13			65.7

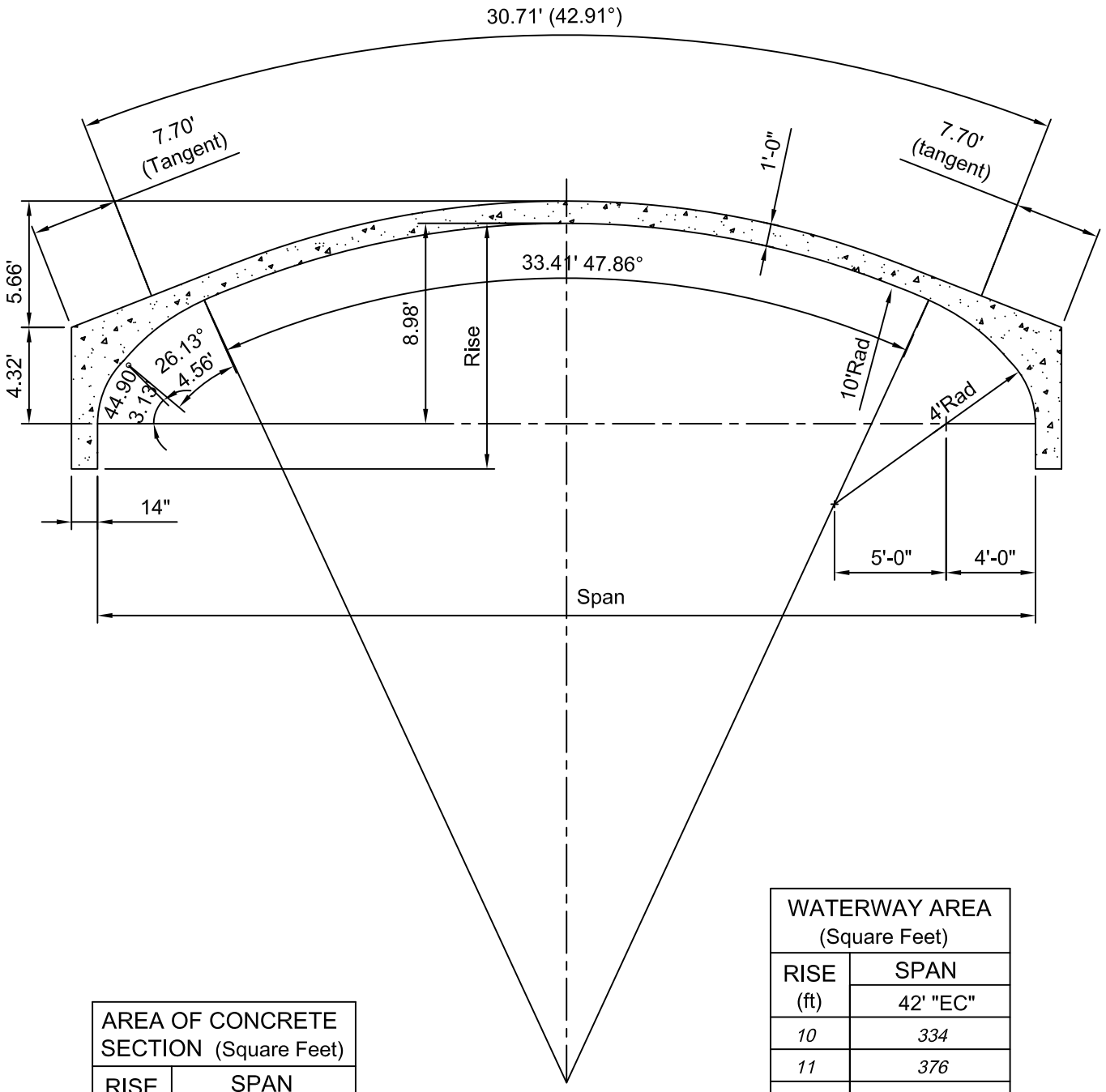
CENTER OF GRAVITY $\bar{y}$ (ft)			
RISE (ft)	SPAN		
	28'	32'	36'
8	6.0	6.0	
9	6.7	6.8	6.5
10	7.4	7.5	7.2
11	8.0	8.2	7.9
12		8.9	8.6
13			9.3

MAXIMUM UNIT LENGTH = 6'-0"

CULVERT DIMENSIONS			
Span	28'	32'	36'
θ	25.30°	31.54°	37.93°
L	17.66'	22.02'	26.48'
a	0.00'	2.15'	4.48'
b_1	0.97'	1.51'	2.17'
b_2	1.96'	2.18'	2.40'
c	3.76'	3.88'	3.91'
d	2.84'	3.63'	4.48'
e	4.07'	3.96'	3.83'
t_1	12"	12"	14"
t_2	10"@ ℄	12"	12"

GEOMETRIC PROPERTIES LONG-SPAN SERIES
FORM SYSTEM A

CON/SPAN® BRIDGE SYSTEMS



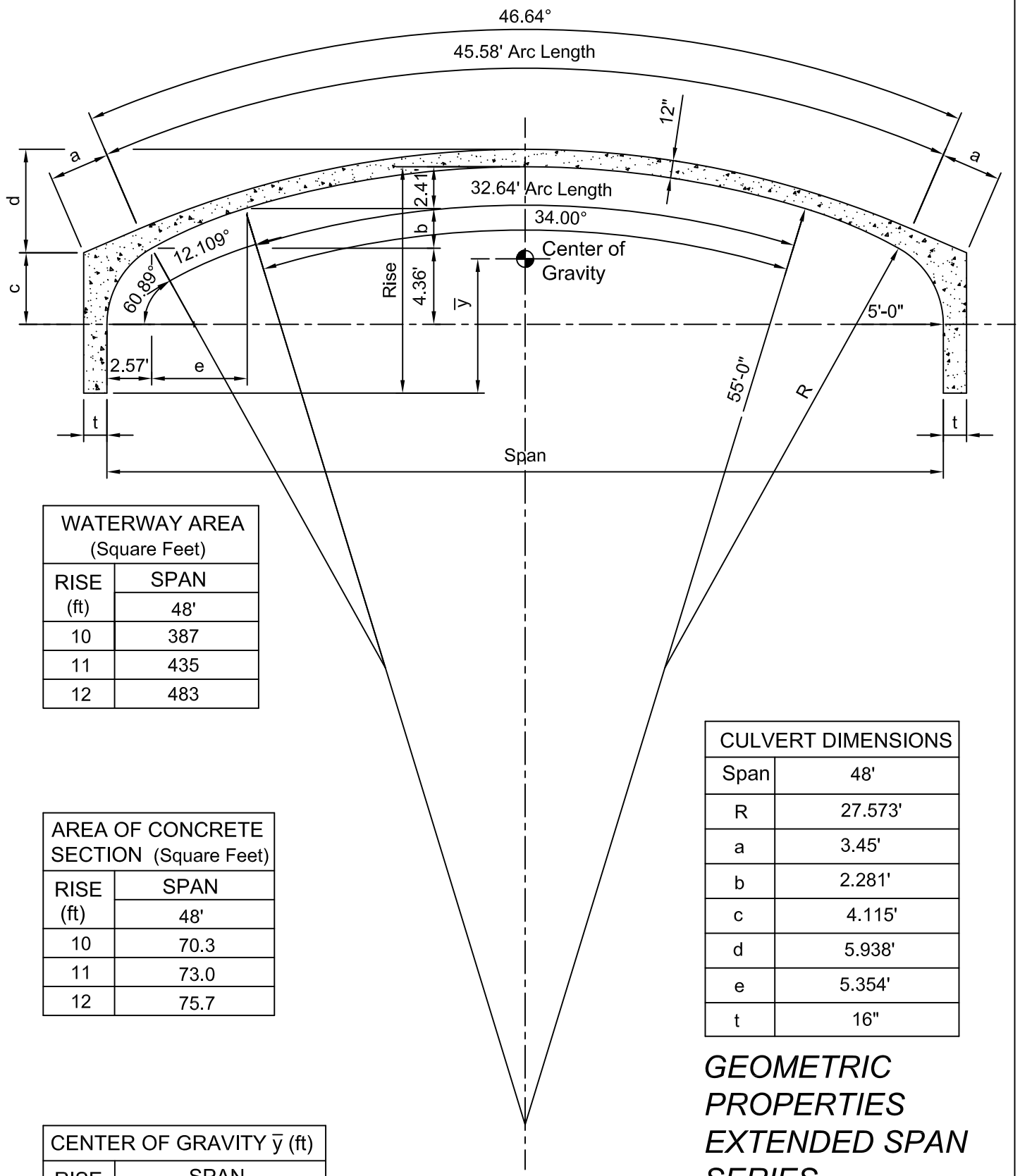
AREA OF CONCRETE SECTION (Square Feet)	
RISE (ft)	SPAN 42' "EC"
10	*64.7*
11	*67.0*
12	*69.4*
13	*71.7*
14	*74.1*

WATERWAY AREA (Square Feet)	
RISE (ft)	SPAN 42' "EC"
10	*334*
11	*376*
12	*418*
13	*460*
14	*502*

*GEOMETRIC PROPERTIES MODIFIED LONG SPAN****

*** Note: Geometry may vary slightly depending upon location of production, call CON/SPAN® for details.

CON/SPAN® BRIDGE SYSTEMS



WATERWAY AREA (Square Feet)	
RISE (ft)	SPAN 48'
10	387
11	435
12	483

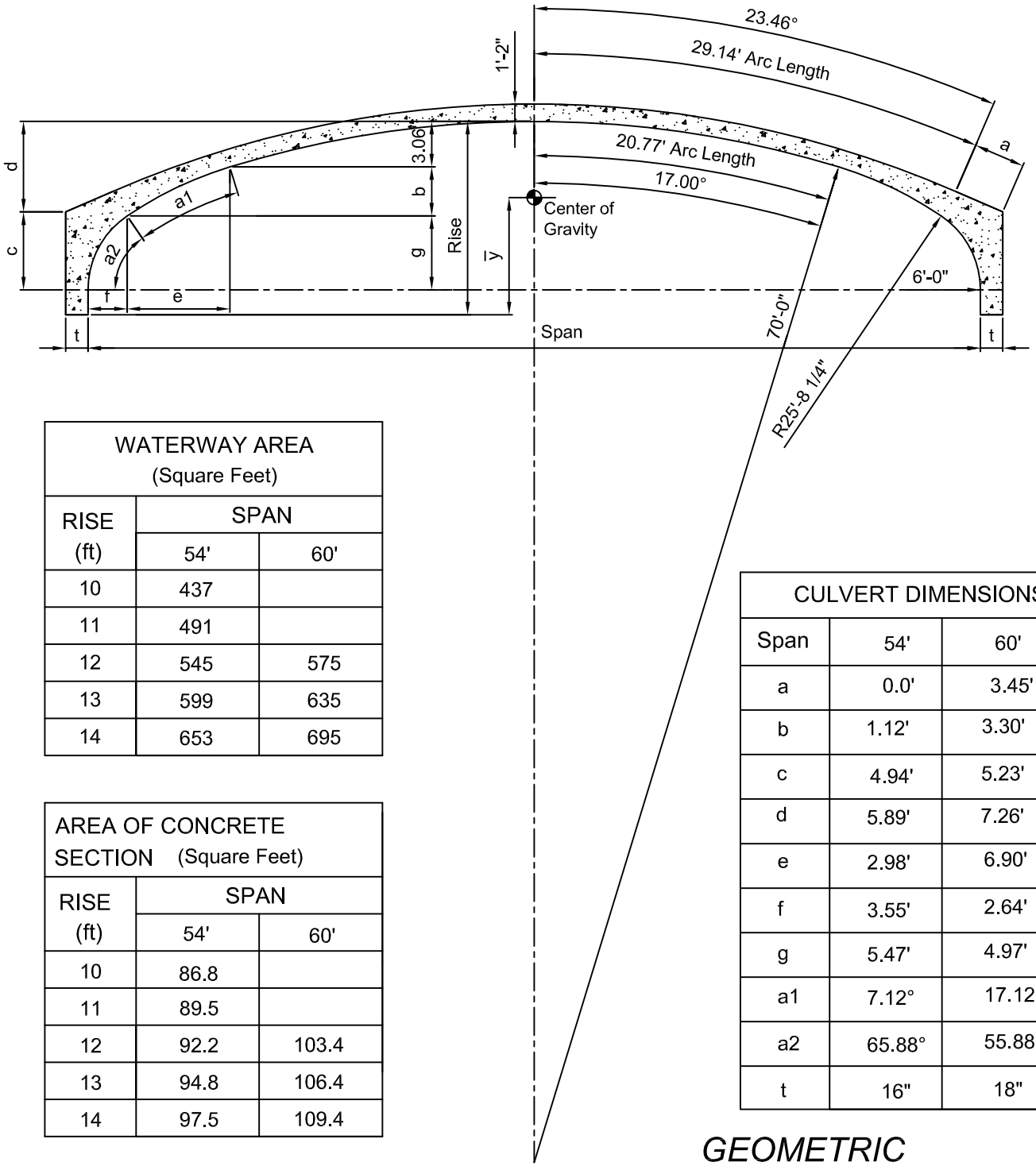
AREA OF CONCRETE SECTION (Square Feet)	
RISE (ft)	SPAN 48'
10	70.3
11	73.0
12	75.7

CENTER OF GRAVITY $\bar{y}$ (ft)	
RISE (ft)	SPAN 48'
10	7.1
11	7.8
12	8.5

CULVERT DIMENSIONS	
Span	48'
R	27.573'
a	3.45'
b	2.281'
c	4.115'
d	5.938'
e	5.354'
t	16"

GEOMETRIC PROPERTIES EXTENDED SPAN SERIES

CON/SPAN® BRIDGE SYSTEMS



WATERWAY AREA (Square Feet)		
RISE (ft)	SPAN	
	54'	60'
10	437	
11	491	
12	545	575
13	599	635
14	653	695

AREA OF CONCRETE SECTION (Square Feet)		
RISE (ft)	SPAN	
	54'	60'
10	86.8	
11	89.5	
12	92.2	103.4
13	94.8	106.4
14	97.5	109.4

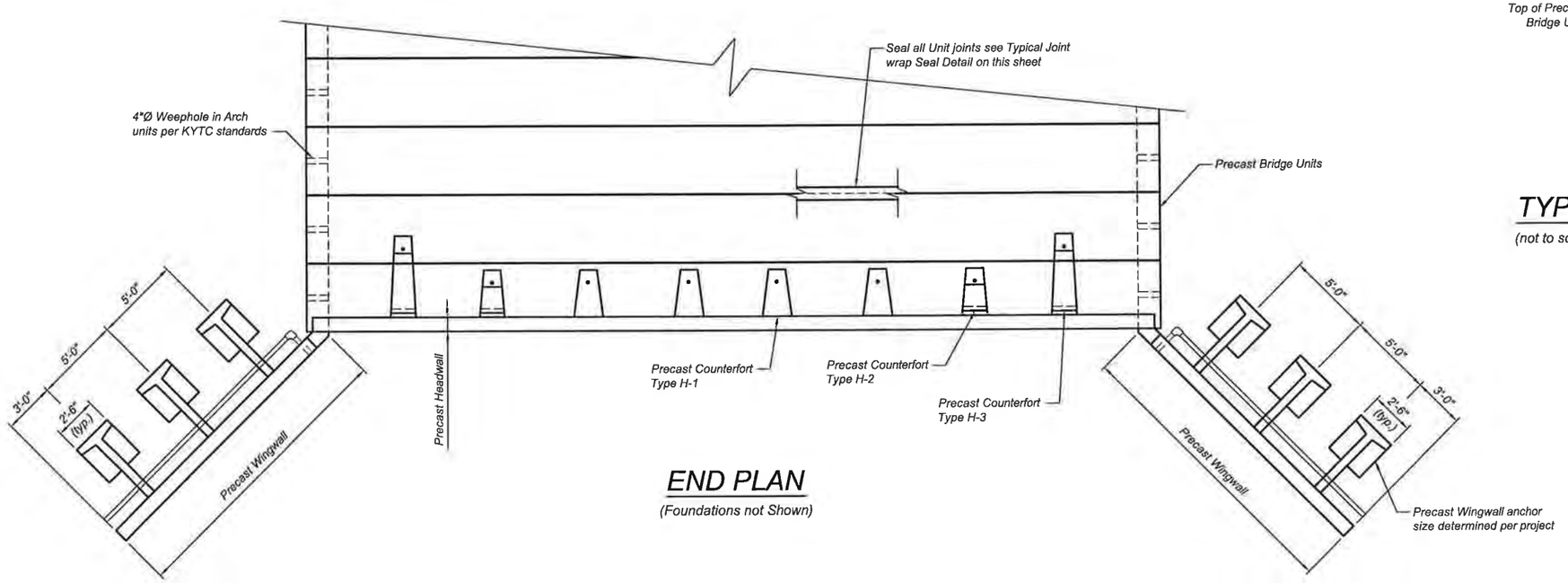
CENTER OF GRAVITY $\bar{y}$ (ft)		
RISE (ft)	SPAN	
	54'	60'
10	7.34	
11	8.10	
12	8.86	8.51
13	9.60	9.25
14	10.32	9.98

CULVERT DIMENSIONS		
Span	54'	60'
a	0.0'	3.45'
b	1.12'	3.30'
c	4.94'	5.23'
d	5.89'	7.26'
e	2.98'	6.90'
f	3.55'	2.64'
g	5.47'	4.97'
a1	7.12°	17.12°
a2	65.88°	55.88°
t	16"	18"

GEOMETRIC PROPERTIES MEGA SPAN SERIES

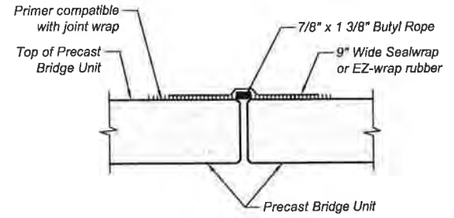
CON/SPAN® BRIDGE SYSTEMS

Revised 1/11/05



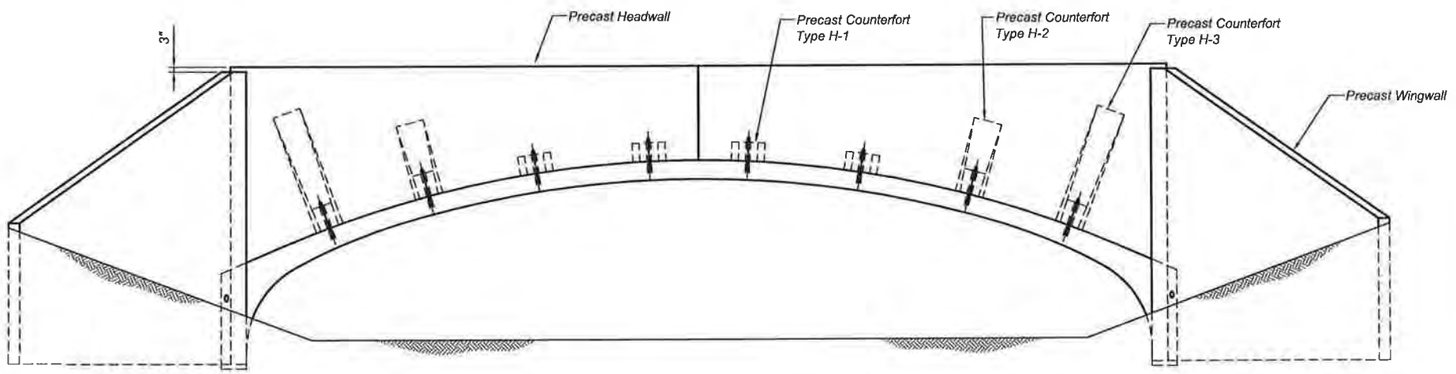
END PLAN

(Foundations not Shown)



TYPICAL JOINT SEAL DETAIL

(not to scale)



END ELEVATION

(Foundations not Shown)

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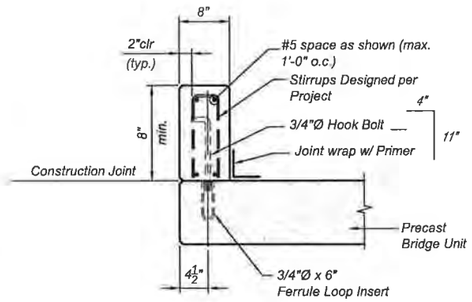
CONSPAN BRIDGE SYSTEMS
CONTECH **PROPOSAL** DRAWING

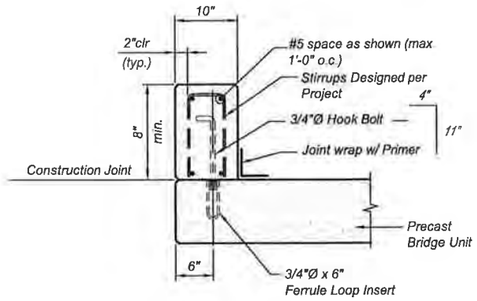
KENTUCKY TRANSPORTATION
CABINET STANDARD DETAILS

FRANKFORT, KENTUCKY

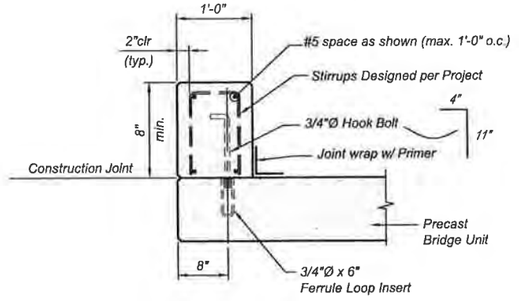
PROJECT No:	SEQ No:	DATE:
	001	6/18/2012
DESIGNED: PAC		DRAWN: JCH
CHECKED: DLW		APPROVED:
SHEET NO.: CT3 OF CT9		



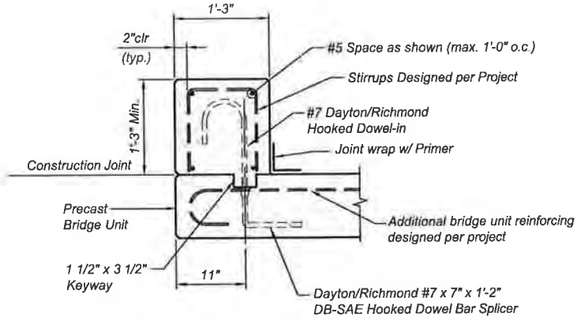
8" ATTACHED HEADWALL



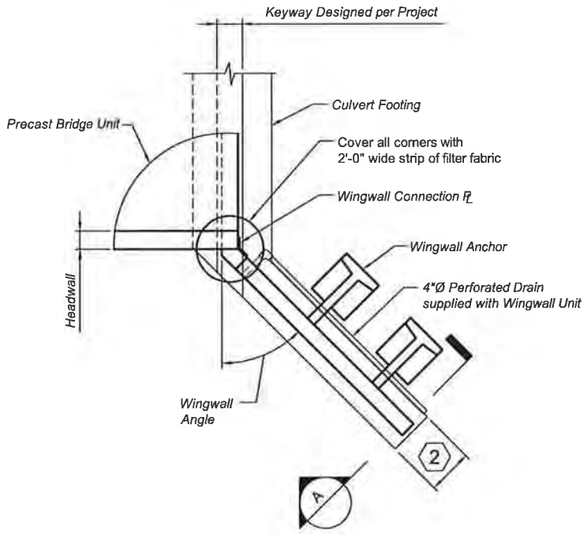
10" ATTACHED HEADWALL



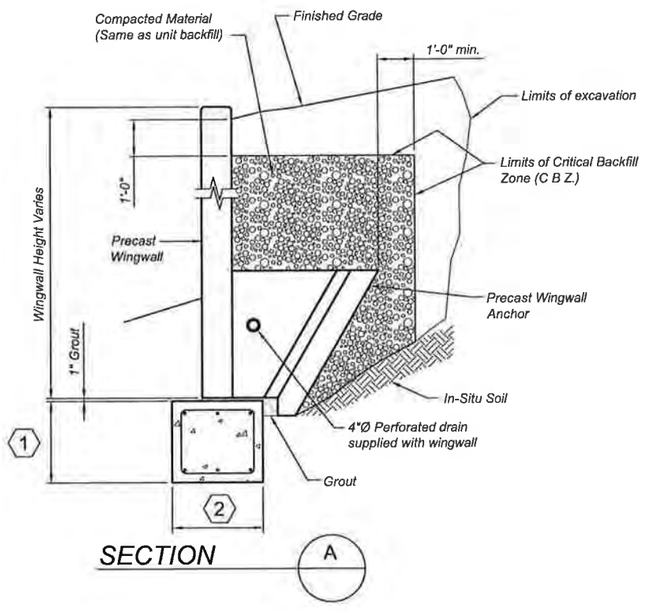
12" ATTACHED HEADWALL



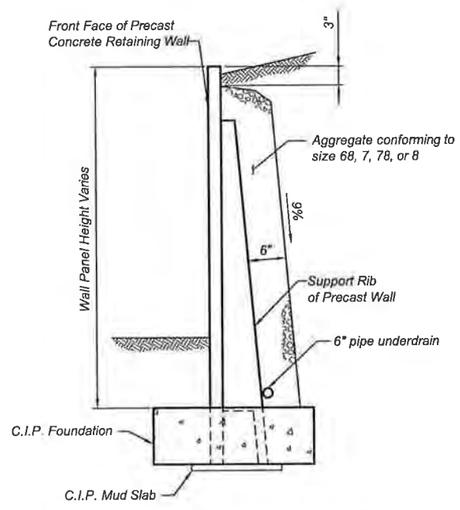
15" ATTACHED HEADWALL FOR GUIDERAIL



PRECAST WINGWALL DETAILS



SECTION A



PRECAST MUR EBAL WALL PANEL

NOTES:

1. Footing depth determined by scour considerations
2. Wingwall footing width determined by allowable soil bearing.
3. For level installation, top of culvert and wingwall footings at same elevation
   For sloping installation, top of footings to be on same plane
4. Provide bent bars to make culvert and wingwall footing reinforcing continuous

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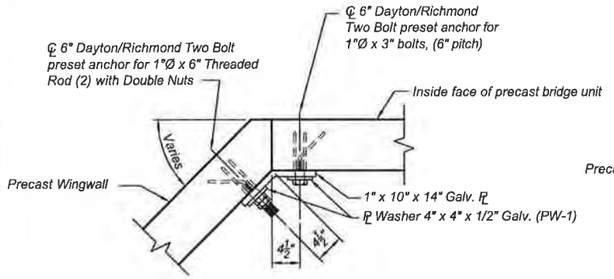
CONTECH PROPOSAL DRAWING

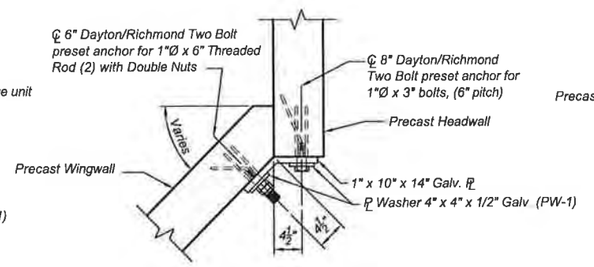
KENTUCKY TRANSPORTATION CABINET STANDARD DETAILS

FRANKFORT, KENTUCKY

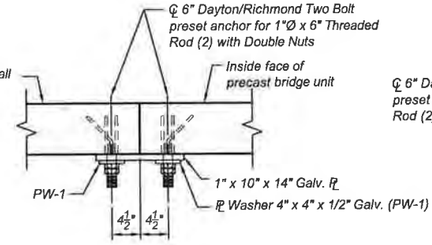
PROJECT No.:	SEQ. No.:	DATE:
	001	6/18/2012
DESIGNED: PAC	DRAWN: JCH	
CHECKED: DLW	APPROVED:	
SHEET NO.: CT4 OF CT9		



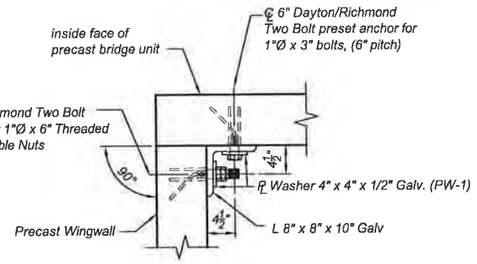
45° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL



45° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL

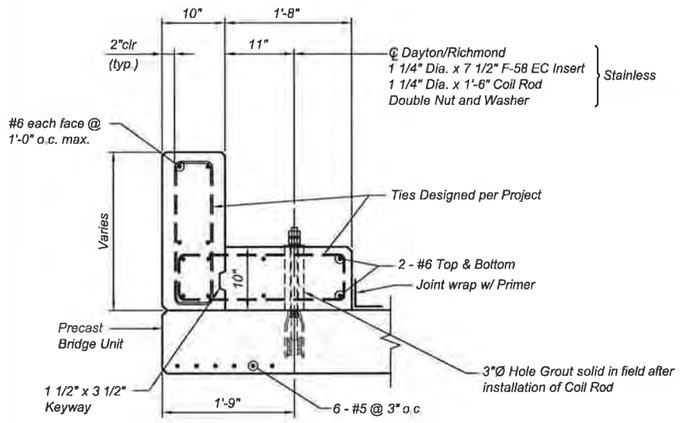


0° WINGWALL CONNECTION PLATE DETAIL @ UNIT LEG

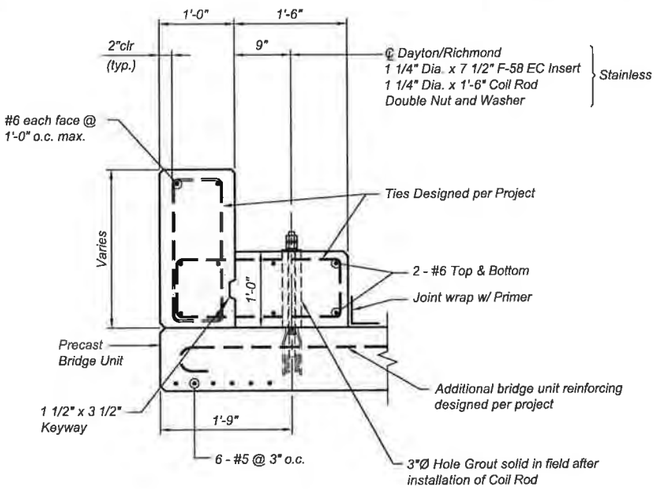


90° WINGWALL CONNECTION PLATE DETAIL @ UNIT LEG

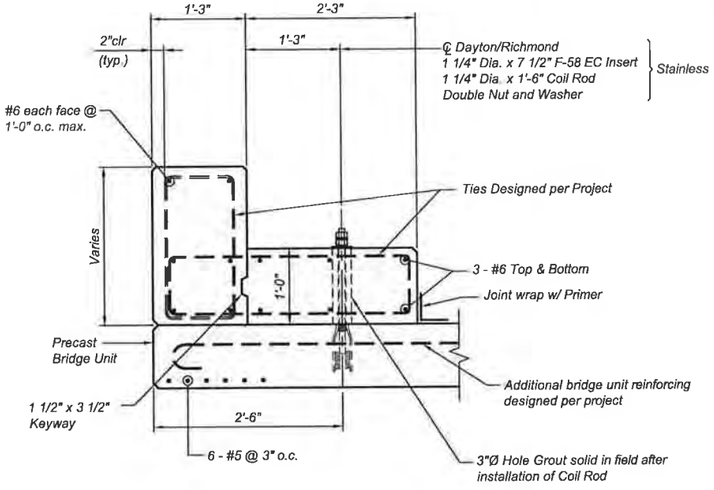
Notes:
1. Standard wingwall angles are 0, 30, 45, 60, and 90 degrees. Special angles may be fabricated to meet specific site requirements.
2. Joints between Wingwall sections and joints between a Wingwall and Bridge Unit shall be sealed with 2'-0" wide strip of Filter Fabric.



10" DETACHED HEADWALL CONTINUOUS COLLAR



12" DETACHED HEADWALL CONTINUOUS COLLAR



15" DETACHED HEADWALL CONTINUOUS COLLAR -FOR GUIDERAIL

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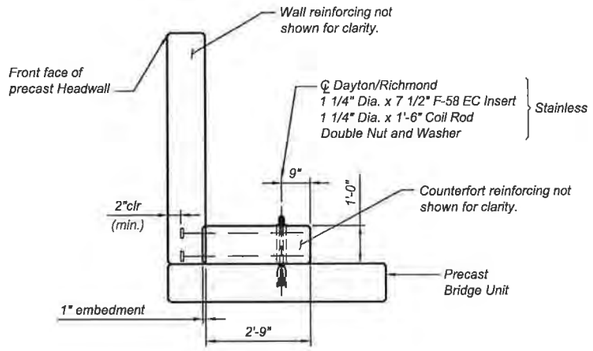
CONSPAN BRIDGE SYSTEMS
CONTECH **PROPOSAL** DRAWING

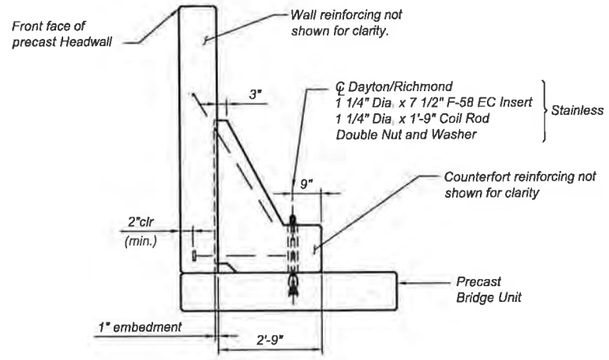
KENTUCKY TRANSPORTATION CABINET STANDARD DETAILS

FRANKFORT, KENTUCKY

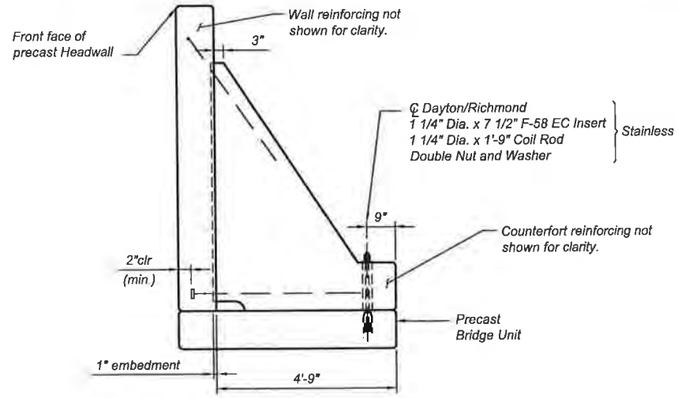
PROJECT No.:	SEQ. No.: 001	DATE: 6/18/2012
DESIGNED: PAC	DRAWN: JCH	
CHECKED: DLW	APPROVED:	
SHEET NO.: CT5 OF CT9		



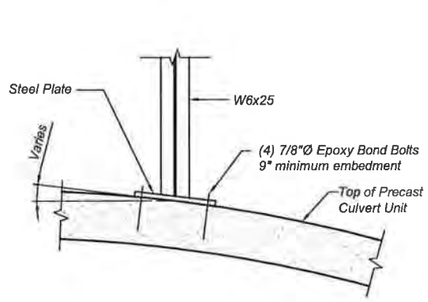
DETACHED HEADWALL COUNTERFORT TYPE H-1

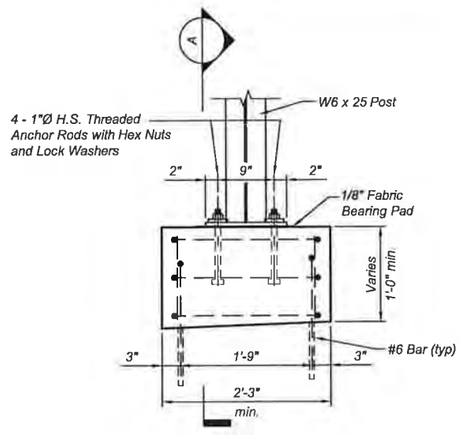


DETACHED HEADWALL COUNTERFORT TYPE H-2

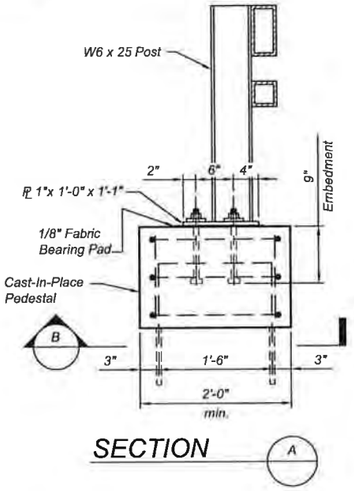


DETACHED HEADWALL COUNTERFORT TYPE H-3



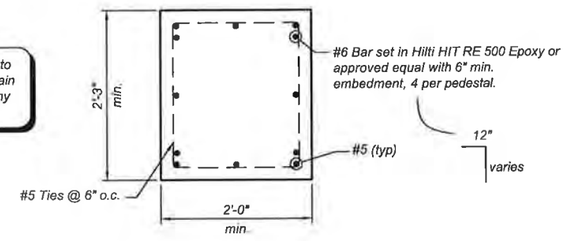


C.I.P. PEDESTAL DETAIL



SECTION A

* Drill holes in Precast Unit to accept a #6 Dowel. Maintain 4" min. clear edge from any culvert joint.



SECTION B

MARK	DATE	REVISION DESCRIPTION	BY

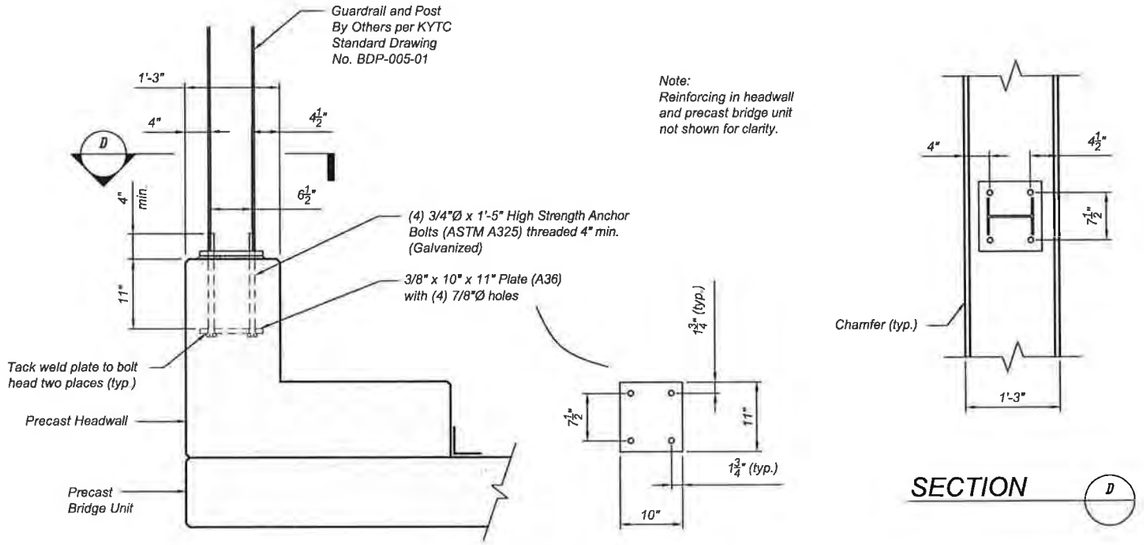
CONTECH BRIDGE SOLUTIONS
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONSPAN BRIDGE SYSTEMS
CONTECH **PROPOSAL** DRAWING

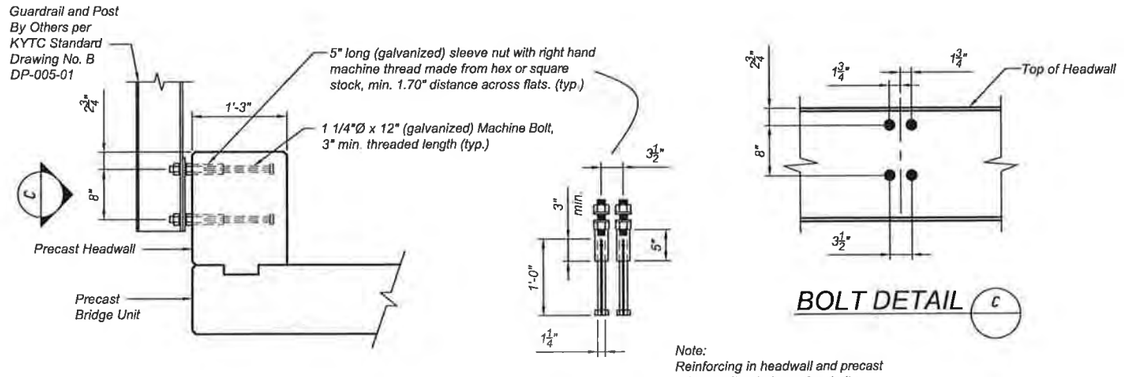
KENTUCKY TRANSPORTATION CABINET STANDARD DETAILS

FRANKFORT, KENTUCKY

PROJECT No:	SEQ. No.:	DATE:
	001	6/18/2012
DESIGNED: PAC		DRAWN: JCH
CHECKED: DLW		APPROVED:
SHEET NO.: CT6 OF CT9		



TOP MOUNTED GUARDRAIL CONNECTION



SIDE MOUNTED GUARDRAIL CONNECTION

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH BRIDGE SOLUTIONS
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9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
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CONSPAN BRIDGE SYSTEMS
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KENTUCKY TRANSPORTATION CABINET STANDARD DETAILS

FRANKFORT, KENTUCKY

PROJECT No.:	SEQ. No.:	DATE:
	001	6/18/2012
DESIGNED: PAC	DRAWN: JCH	
CHECKED: DLW	APPROVED:	
SHEET NO.: CT7 OF CT9		

SPECIFICATIONS FOR MANUFACTURE AND INSTALLATION OF CON/SPAN® BRIDGE SYSTEMS

1. DESCRIPTION
   1.1. TYPE - THIS WORK SHALL CONSIST OF FURNISHING AND CONSTRUCTING A CON/SPAN® BRIDGE SYSTEM IN ACCORDANCE WITH THESE SPECIFICATIONS AND IN REASONABLY CLOSE CONFORMITY WITH THE LINES, GRADES, DESIGN AND DIMENSIONS SHOWN ON THE PLANS OR AS ESTABLISHED BY THE ENGINEER. IN SITUATIONS WHERE TWO OR MORE SPECIFICATIONS APPLY TO THIS WORK, THE MOST STRINGENT REQUIREMENTS SHALL GOVERN.
   1.2. DESIGNATION - PRECAST REINFORCED CONCRETE CON/SPAN® BRIDGE UNITS MANUFACTURED IN ACCORDANCE WITH THIS SPECIFICATION SHALL BE DESIGNATED BY SPAN AND RISE. PRECAST REINFORCED CONCRETE WINGWALLS AND HEADWALLS MANUFACTURED IN ACCORDANCE WITH THIS SPECIFICATION SHALL BE DESIGNATED BY LENGTH, HEIGHT, AND DEFLECTION ANGLE.

2. DESIGN
   2.1. SPECIFICATIONS - THE PRECAST ELEMENTS ARE DESIGNED IN ACCORDANCE WITH THE "AASHTO LRFD BRIDGE SPECIFICATION" 4TH EDITION, ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, 2007. A MINIMUM OF 1'-6" OF COVER ABOVE THE CROWN OF THE BRIDGE UNITS IS REQUIRED IN THE INSTALLED CONDITION. (UNLESS NOTED OTHERWISE ON THE SHOP DRAWINGS AND DESIGNED ACCORDINGLY.)

3. MATERIALS
   3.1. CONCRETE - THE CONCRETE FOR THE PRECAST ELEMENTS SHALL BE AIR-ENTRAINED WHEN INSTALLED IN AREAS SUBJECT TO FREEZE-THAW CONDITIONS, COMPOSED OF PORTLAND CEMENT, FINE AND COARSE AGGREGATES, ADMIXTURES AND WATER. AIR-ENTRAINED CONCRETE SHALL CONTAIN 6 ± 2 PERCENT AIR. THE AIR- ENTRAINING ADMIXTURE SHALL CONFORM TO AASHT0 M154. THE MINIMUM CONCRETE COMPRESSIVE STRENGTH SHALL BE AS SHOWN ON THE SHOP DRAWINGS.
      3.1.1. PORTLAND CEMENT - SHALL CONFORM TO THE REQUIREMENTS OF ASTM SPECIFICATIONS C150-TYPE I, TYPE II, OR TYPE III CEMENT.
      3.1.2. COARSE AGGREGATE - SHALL CONSIST OF STONE HAVING A MAXIMUM SIZE OF 1 INCH. AGGREGATE SHALL MEET REQUIREMENTS FOR ASTM C33.
      3.1.3. WATER REDUCING ADMIXTURE - THE MANUFACTURER MAY SUBMIT, FOR APPROVAL BY THE ENGINEER, A WATER-REDUCING ADMIXTURE FOR THE PURPOSE OF INCREASING WORKABILITY AND REDUCING THE WATER REQUIREMENT FOR THE CONCRETE.
      3.1.4. CALCIUM CHLORIDE - THE ADDITION TO THE MIX OF CALCIUM CHLORIDE OR ADMIXTURES CONTAINING CALCIUM CHLORIDE WILL NOT BE PERMITTED.
      3.1.5. MIXTURE - THE AGGREGATES, CEMENT AND WATER SHALL BE PROPORTIONED AND MIXED IN A BATCH MIXER TO PRODUCE A HOMOGENEOUS CONCRETE MEETING THE STRENGTH REQUIREMENTS OF THIS SPECIFICATION. THE PROPORTION OF PORTLAND CEMENT IN THE MIXTURE SHALL NOT BE LESS THAN 564 POUNDS (6 SACKS) PER CUBIC YARD OF CONCRETE.
   3.2. STEEL REINFORCEMENT
      3.2.1. THE MINIMUM STEEL YIELD STRENGTH SHALL BE 60,000 PSI, UNLESS OTHERWISE NOTED ON THE SHOP DRAWINGS.
      3.2.2. ALL REINFORCING STEEL FOR THE PRECAST ELEMENTS SHALL BE FABRICATED AND PLACED IN ACCORDANCE WITH THE DETAILED SHOP DRAWINGS SUBMITTED BY THE MANUFACTURER.
      3.2.3. REINFORCEMENT SHALL CONSIST OF WELDED WIRE FABRIC CONFORMING TO ASTM SPECIFICATION A 185 OR A 497, OR DEFORMED BILLET STEEL BARS CONFORMING TO ASTM SPECIFICATION A 615, GRADE 60. LONGITUDINAL DISTRIBUTION REINFORCEMENT MAY CONSIST OF WELDED WIRE FABRIC OR DEFORMED BILLET-STEEL BARS.
   3.3. STEEL HARDWARE
      3.3.1. BOLTS AND THREADED RODS FOR WINGWALL CONNECTIONS SHALL CONFORM TO ASTM A 307. NUTS SHALL CONFORM TO AASHTO M292 (ASTM A194) GRADE 2H. ALL BOLTS, THREADED RODS AND NUTS USED IN WINGWALL CONNECTIONS SHALL BE MECHANICALLY ZINC COATED IN ACCORDANCE WITH ASTM B695 CLASS 50.
      3.3.2. STRUCTURAL STEEL FOR WINGWALL CONNECTION PLATES AND PLATE WASHERS SHALL CONFORM TO AASHTO M 270 (ASTM A 709) GRADE 36 AND SHALL BE HOT DIP GALVANIZED AS PER AASHTO M111 (ASTM A123).
      3.3.3. INSERTS FOR WINGWALLS SHALL BE 1" DIAMETER TWO-BOLT PRESET WINGWALL ANCHORS AS MANUFACTURED BY DAYTON/RICHMOND CONCRETE ACCESSORIES, MIAMISBURG, OHIO, (800) 745-3700.
      3.3.4. FERRULE LOOP INSERTS SHALL BE F-64 FERRULE LOOP INSERTS AS MANUFACTURED BY DAYTON/RICHMOND CONCRETE ACCESSORIES, MIAMISBURG, OHIO, (800) 745-3700.
      3.3.5. HOOK BOLTS USED IN ATTACHED HEADWALL CONNECTIONS SHALL BE ASTM A307.
      3.3.6. INSERTS FOR DETACHED HEADWALL CONNECTIONS SHALL BE AISI TYPE 304 STAINLESS STEEL, F-58 EXPANDED COIL INSERTS AS MANUFACTURED BY DAYTON/RICHMOND CONCRETE ACCESSORIES, MIAMISBURG, OHIO, (800) 745-3700. COIL RODS AND NUTS USED IN HEADWALL CONNECTIONS SHALL BE AISI TYPE 304 STAINLESS STEEL. WASHERS USED IN HEADWALL CONNECTIONS SHALL BE EITHER AISI TYPE 304 STAINLESS STEEL PLATE WASHERS OR AASHTO M270 (ASTM A709) GRADE 36 PLATE WASHERS HOT DIP GALVANIZED AS PER AASHTO M111 (ASTM A123).
      3.3.7. REINFORCING BAR SPLICES SHALL BE MADE USING THE DOWEL BAR SPLICER SYSTEM AS MANUFACTURED BY DAYTON/RICHMOND CONCRETE ACCESSORIES, MIAMISBURG, OHIO, (800) 745-3700, AND SHALL CONSIST OF THE DOWEL BAR SPLICER (DB-SAE) AND DOWEL-IN (DI).

4. MANUFACTURE OF PRECAST ELEMENTS - SUBJECT TO THE PROVISIONS OF SECTION 5, BELOW, THE PRECAST ELEMENT DIMENSION AND REINFORCEMENT DETAILS SHALL BE AS PRESCRIBED IN THE PLAN AND SHOP DRAWINGS PROVIDED BY THE MANUFACTURER.
   4.1. FORMS - THE FORMS USED IN MANUFACTURE SHALL BE SUFFICIENTLY RIGID AND ACCURATE TO MAINTAIN THE REQUIRED PRECAST ELEMENT DIMENSIONS WITHIN THE PERMISSIBLE VARIATIONS GIVEN IN SECTION 5 OF THESE SPECIFICATIONS. ALL CASTING SURFACES SHALL BE OF A SMOOTH MATERIAL.
   4.2. PLACEMENT OF REINFORCEMENT
      4.2.1. PLACEMENT OF REINFORCEMENT IN PRECAST BRIDGE UNITS - THE COVER OF CONCRETE OVER THE OUTSIDE CIRCUMFERENTIAL REINFORCEMENT SHALL BE 2" MINIMUM. THE COVER OF CONCRETE OVER THE INSIDE CIRCUMFERENTIAL REINFORCEMENT SHALL BE 1½" MINIMUM, UNLESS OTHERWISE NOTED ON THE SHOP DRAWINGS. THE CLEAR DISTANCE OF THE END CIRCUMFERENTIAL WIRES SHALL NOT BE LESS THAN 1" NOR MORE THAN 2" FROM THE ENDS OF EACH SECTION. REINFORCEMENT SHALL BE ASSEMBLED UTILIZING SINGLE OR MULTIPLE LAYERS OF WELDED WIRE FABRIC (NOT TO EXCEED 3 LAYERS), SUPPLEMENTED WITH A SINGLE LAYER OF DEFORMED BILLET-STEEL BARS, WHEN NECESSARY. WELDED WIRE FABRIC SHALL BE COMPOSED OF CIRCUMFERENTIAL AND LONGITUDINAL WIRES MEETING THE SPACING REQUIREMENTS OF 4.3, BELOW, AND SHALL CONTAIN SUFFICIENT LONGITUDINAL WIRES EXTENDING THROUGH THE BRIDGE UNIT TO MAINTAIN THE SHAPE AND POSITION OF THE REINFORCEMENT. LONGITUDINAL DISTRIBUTION REINFORCEMENT MAY BE WELDED WIRE FABRIC OR DEFORMED BILLET-STEEL BARS AND SHALL MEET THE SPACING REQUIREMENTS OF 4.3, BELOW. THE ENDS OF THE LONGITUDINAL DISTRIBUTION REINFORCEMENT SHALL BE NOT MORE THAN 3" AND NOT LESS THAN 1½" FROM THE ENDS OF THE BRIDGE UNIT.
      4.2.2. BENDING OF REINFORCEMENT FOR PRECAST BRIDGE UNITS - THE OUTSIDE AND INSIDE CIRCUMFERENTIAL REINFORCING STEEL FOR THE CORNERS OF THE BRIDGE SHALL BE BENT TO SUCH AN ANGLE THAT IS APPROXIMATELY EQUAL TO THE CONFIGURATION OF THE BRIDGE'S OUTSIDE CORNER.
      4.2.3. PLACEMENT OF REINFORCEMENT FOR PRECAST WINGWALLS AND HEADWALLS - THE COVER OF CONCRETE OVER THE LONGITUDINAL AND TRANSVERSE REINFORCEMENT SHALL BE 2" MINIMUM. THE CLEAR DISTANCE FROM THE END OF EACH PRECAST ELEMENT TO THE END OF REINFORCING STEEL SHALL NOT BE LESS THAN 1½" NOR MORE THAN 3". REINFORCEMENT SHALL BE ASSEMBLED UTILIZING A SINGLE LAYER OF WELDED WIRE FABRIC, OR A SINGLE LAYER OF DEFORMED BILLET-STEEL BARS. WELDED WIRE FABRIC SHALL BE COMPOSED OF TRANSVERSE AND LONGITUDINAL WIRES MEETING THE SPACING REQUIREMENTS OF 4.3, BELOW, AND SHALL CONTAIN SUFFICIENT LONGITUDINAL WIRES EXTENDING THROUGH THE ELEMENT TO MAINTAIN THE SHAPE AND POSITION OF THE REINFORCEMENT. LONGITUDINAL REINFORCEMENT MAY BE WELDED WIRE FABRIC OR DEFORMED BILLET-STEEL BARS AND SHALL MEET THE SPACING REQUIREMENTS OF 4.3, BELOW.
   4.3. LAPS, WELDS, SPACING
      4.3.1. LAPS, WELDS, AND SPACING FOR PRECAST BRIDGE UNITS - TENSION SPLICES IN THE CIRCUMFERENTIAL REINFORCEMENT SHALL BE MADE BY LAPPING. LAPS MAY BE TACK WELDED TOGETHER FOR ASSEMBLY PURPOSES. FOR SMOOTH WELDED WIRE FABRIC, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO 5.11.2.5.2 AND 5.11.6.2. FOR DEFORMED WELDED WIRE FABRIC, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO 5.11.2.5.1 AND 5.11.6.1. THE OVERLAP OF WELDED WIRE FABRIC SHALL BE MEASURED BETWEEN THE OUTER-MOST LONGITUDINAL WIRES OF EACH FABRIC SHEET. FOR DEFORMED BILLET-STEEL BARS, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO 5.11.2.1 FOR SPLICES OTHER THAN TENSION SPLICES, THE OVERLAP SHALL BE A MINIMUM OF 1'-0" FOR WELDED WIRE FABRIC OR DEFORMED BILLET-STEEL BARS. THE SPACING CENTER TO CENTER OF THE CIRCUMFERENTIAL WIRES IN A WIRE FABRIC SHEET SHALL BE NOT LESS THAN 2" NOR MORE THAN 4". THE SPACING CENTER TO CENTER OF THE LONGITUDINAL WIRES SHALL NOT BE MORE THAN 8". THE SPACING CENTER TO CENTER OF THE LONGITUDINAL DISTRIBUTION STEEL FOR EITHER LINE OF REINFORCING IN THE TOP SLAB SHALL BE NOT MORE THAN 1'-4".
      4.3.2. LAPS, WELDS, AND SPACING FOR PRECAST WINGWALLS AND HEADWALLS - SPLICES IN THE REINFORCEMENT SHALL BE MADE BY LAPPING. LAPS MAY BE TACK WELDED TOGETHER FOR ASSEMBLY PURPOSES. FOR SMOOTH WELDED WIRE FABRIC, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO 5.11.2.5.2 AND 5.11.6.2. FOR DEFORMED WELDED WIRE FABRIC, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO 5.11.2.5.1 AND 5.11.6.1. FOR DEFORMED BILLET-STEEL BARS, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO 5.11.2.1. THE SPACING CENTER-TO-CENTER OF THE WIRES IN A WIRE FABRIC SHEET SHALL BE NOT LESS THAN 2" NOR MORE THAN 8".
   4.4. CURING - THE PRECAST CONCRETE ELEMENTS SHALL BE CURED FOR A SUFFICIENT LENGTH OF TIME SO THAT THE CONCRETE WILL DEVELOP THE SPECIFIED COMPRESSIVE STRENGTH IN 28 DAYS OR LESS. ANY ONE OF THE FOLLOWING METHODS OF CURING OR COMBINATIONS THERE OF SHALL BE USED:
      4.4.1. STEAM CURING - THE PRECAST ELEMENTS MAY BE LOW-PRESSURE STEAM CURED BY A SYSTEM THAT WILL MAINTAIN A MOIST ATMOSPHERE.
      4.4.2. WATER CURING - THE PRECAST ELEMENTS MAY BE WATER CURED BY ANY METHOD THAT WILL KEEP THE SECTIONS MOIST.
      4.4.3. MEMBRANE CURING - A SEALING MEMBRANE CONFORMING TO THE REQUIREMENTS OF ASTM SPECIFICATION C309 MAY BE APPLIED AND SHALL BE LEFT INTACT UNTIL THE REQUIRED CONCRETE COMPRESSIVE STRENGTH IS ATTAINED. THE CONCRETE TEMPERATURE AT THE TIME OF STRENGTH IS ATTAINED. THE CONCRETE TEMPERATURE AT THE TIME OF APPLICATION SHALL BE WITHIN +/- 10 DEGREES F OF THE ATMOSPHERIC TEMPERATURE. ALL SURFACES SHALL BE KEPT MOIST PRIOR TO THE APPLICATION OF THE COMPOUNDS AND SHALL BE DAMP WHEN THE COMPOUND IS APPLIED.
   4.5. STORAGE, HANDLING & DELIVERY
      4.5.1. STORAGE - PRECAST CONCRETE BRIDGE ELEMENTS SHALL BE LIFTED AND STORED IN "AS-CAST" POSITION. PRECAST CONCRETE HEADWALL AND WINGWALL UNITS ARE CAST, STORED AND SHIPPED IN A FLAT POSITION. THE PRECAST ELEMENTS SHALL BE STORED IN SUCH A MANNER TO PREVENT CRACKING OR DAMAGE. STORE ELEMENTS USING TIMBER SUPPORTS AS APPROPRIATE. THE UNITS SHALL NOT BE MOVED UNTIL THE CONCRETE COMPRESSIVE STRENGTH HAS REACHED A MINIMUM OF 2500 PSI, AND THEY SHALL NOT BE STORED IN AN UPRIGHT POSITION.
      4.5.2. HANDLING - HANDLING DEVICES SHALL BE PERMITTED IN EACH PRECAST ELEMENT FOR THE PURPOSE OF HANDLING AND SETTING. SPREADER BEAMS MAY BE REQUIRED FOR THE LIFTING OF PRECAST CONCRETE BRIDGE ELEMENTS TO PRECLUDE DAMAGE FROM BENDING OR TORSION FORCES.
      4.5.3. DELIVERY - PRECAST CONCRETE ELEMENTS MUST NOT BE SHIPPED UNTIL THE CONCRETE HAS ATTAINED THE SPECIFIED DESIGN COMPRESSIVE STRENGTH, OR AS DIRECTED BY THE DESIGN ENGINEER. PRECAST CONCRETE ELEMENTS MAY BE UNLOADED AND PLACED ON THE GROUND AT THE SITE UNTIL INSTALLED. STORE ELEMENTS USING TIMBER SUPPORTS AS APPROPRIATE.
   4.6. QUALITY ASSURANCE - THE PRECASTER SHALL DEMONSTRATE ADHERENCE TO THE STANDARDS SET FORTH IN THE NPCA QUALITY CONTROL MANUAL. THE PRECASTER SHALL MEET EITHER SECTION 4.6.1 OR 4.6.2
      4.6.1. CERTIFICATION - THE PRECASTER SHALL BE CERTIFIED BY THE PRECAST/PRESTRESSED CONCRETE INSTITUTE PLANT CERTIFICATION PROGRAM OR THE NATIONAL PRECAST CONCRETE ASSOCIATION'S PLANT CERTIFICATION PROGRAM PRIOR TO AND DURING PRODUCTION OF THE PRODUCTS COVERED BY THIS SPECIFICATION.
      4.6.2. QUALIFICATIONS, TESTING AND INSPECTION
         4.6.2.1. THE PRECASTER SHALL HAVE BEEN IN THE BUSINESS OF PRODUCING PRECAST CONCRETE PRODUCTS SIMILAR TO THOSE SPECIFIED FOR A MINIMUM OF THREE YEARS. HE SHALL MAINTAIN A PERMANENT QUALITY CONTROL DEPARTMENT OR RETAIN AN INDEPENDENT TESTING AGENCY ON A CONTINUING BASIS. THE AGENCY SHALL ISSUE A REPORT, CERTIFIED BY A LICENSED ENGINEER, DETAILING THE ABILITY OF THE PRECASTER TO PRODUCE QUALITY PRODUCTS CONSISTENT WITH INDUSTRY STANDARDS.
         4.6.2.2. THE PRECASTER SHALL SHOW THAT THE FOLLOWING TESTS ARE PERFORMED IN ACCORDANCE WITH THE ASTM STANDARDS INDICATED. TESTS SHALL BE PERFORMED AS INDICATED IN SECTION 6 OF THESE SPECIFICATIONS.
            4.6.2.2.1. AIR CONTENT: C231 OR C173
            4.6.2.2.2. COMPRESSIVE STRENGTH: C31,C39,C497
         4.6.2.3. THE PRECASTER SHALL PROVIDE DOCUMENTATION DEMONSTRATING COMPLIANCE WITH THIS SECTION TO CONTECH® BRIDGE SOLUTIONS AT REGULAR INTERVALS OR UPON REQUEST.
         4.6.2.4. THE OWNER MAY PLACE AN INSPECTOR IN THE PLANT WHEN THE PRODUCTS COVERED BY THIS SPECIFICATION ARE BEING MANUFACTURED.
      4.6.3. DOCUMENTATION - THE PRECASTER SHALL SUBMIT PRECAST PRODUCTION REPORTS TO CONTECH® BRIDGE SOLUTIONS AS REQUIRED.

5. PERMISSIBLE VARIATIONS
   5.1. BRIDGE UNITS
      5.1.1. INTERNAL DIMENSIONS - THE INTERNAL DIMENSION SHALL VARY NOT MORE THAN 1% FROM THE DESIGN DIMENSIONS NOR MORE THAN 1½" WHICHEVER IS LESS.
      5.1.2. SLAB AND WALL THICKNESS - THE SLAB AND WALL THICKNESS SHALL NOT BE LESS THAN THAT SHOWN IN THE DESIGN BY MORE THAN ¼". A THICKNESS MORE THAN THAT REQUIRED IN THE DESIGN SHALL NOT BE CAUSE FOR REJECTION.
      5.1.3. LENGTH OF OPPOSITE SURFACES - VARIATIONS IN LAYING LENGTHS OF TWO OPPOSITE SURFACES OF THE BRIDGE UNIT SHALL NOT BE MORE THAN ½" IN ANY SECTION, EXCEPT WHERE BEVELED ENDS FOR LAYING OF CURVES ARE SPECIFIED BY THE PURCHASER.
      5.1.4. LENGTH OF SECTION - THE UNDERRUN IN LENGTH OF A SECTION SHALL NOT BE MORE THAN ½" IN ANY BRIDGE UNIT.
      5.1.5. POSITION OF REINFORCEMENT - THE MAXIMUM VARIATION IN POSITION OF THE REINFORCEMENT SHALL BE ± ½". IN NO CASE SHALL THE COVER OVER THE REINFORCEMENT BE LESS THAN 1½" FOR THE OUTSIDE CIRCUMFERENTIAL STEEL OR BE LESS THAN 1" FOR THE INSIDE CIRCUMFERENTIAL STEEL AS MEASURED TO THE EXTERNAL OR INTERNAL SURFACE OF THE BRIDGE. THESE TOLERANCES OR COVER REQUIREMENTS DO NOT APPLY TO MATING SURFACES OF THE JOINTS.
      5.1.6. AREA OF REINFORCEMENT - THE AREAS OF STEEL REINFORCEMENT SHALL BE THE DESIGN STEEL AREAS AS SHOWN IN THE MANUFACTURER'S SHOP DRAWINGS. STEEL AREAS GREATER THAN THOSE REQUIRED SHALL NOT BE CAUSE FOR REJECTION. THE PERMISSIBLE VARIATION IN DIAMETER OF ANY REINFORCEMENT SHALL CONFORM TO THE TOLERANCES PRESCRIBED IN THE ASTM SPECIFICATION FOR THAT TYPE OF REINFORCEMENT.
   5.2. WINGWALLS & HEADWALLS
      5.2.1. WALL THICKNESS - THE WALL THICKNESS SHALL NOT VARY FROM THAT SHOWN IN THE DESIGN BY MORE THAN ½".
      5.2.2. LENGTH/HEIGHT OF WALL SECTIONS - THE LENGTH AND HEIGHT OF THE WALL SHALL NOT VARY FROM THAT SHOWN IN THE DESIGN BY MORE THAN ½".
      5.2.3. POSITION OF REINFORCEMENT - THE MAXIMUM VARIATION IN THE POSITION OF THE REINFORCEMENT SHALL BE ± ½". IN NO CASE SHALL THE COVER OVER THE REINFORCEMENT BE LESS THAN 1½".
      5.2.4. SIZE OF REINFORCEMENT - THE PERMISSIBLE VARIATION IN DIAMETER OF ANY REINFORCING SHALL CONFORM TO THE TOLERANCES PRESCRIBED IN THE ASTM SPECIFICATION FOR THAT TYPE OF REINFORCING. STEEL AREA GREATER THAN THAT REQUIRED SHALL NOT BE CAUSE FOR REJECTION.

6. TESTING/ INSPECTION
   6.1. TESTING
      6.1.1. TYPE OF TEST SPECIMEN - CONCRETE COMPRESSIVE STRENGTH SHALL BE DETERMINED FROM COMPRESSION TESTS MADE ON CYLINDERS OR CORES. FOR CYLINDER TESTING, A MINIMUM OF 4 CYLINDERS SHALL BE TAKEN FOR EACH BRIDGE ELEMENT. EACH ELEMENT SHALL BE CONSIDERED SEPARATELY FOR THE PURPOSE OF TESTING AND ACCEPTANCE.
      6.1.2. COMPRESSION TESTING - CYLINDERS SHALL BE MADE AND TESTED AS PRESCRIBED BY THE ASTM C39 SPECIFICATION. CYLINDERS SHALL BE CURED IN THE SAME ENVIRONMENT AS THE BRIDGE ELEMENTS. CORES SHALL BE OBTAINED AND TESTED FOR COMPRESSIVE STRENGTH IN ACCORDANCE WITH THE PROVISIONS OF THE ASTM C42 SPECIFICATION.
      6.1.3. ACCEPTABILITY OF CYLINDER TESTS - WHEN THE AVERAGE COMPRESSIVE STRENGTH OF ALL CYLINDERS TESTED IS EQUAL TO OR GREATER THAN THE DESIGN COMPRESSIVE STRENGTH, AND NOT MORE THAN 10% OF THE CYLINDERS TESTED HAVE A COMPRESSIVE STRENGTH LESS THAN THE DESIGN CONCRETE STRENGTH, AND NO CYLINDER TESTED HAS A COMPRESSIVE STRENGTH LESS THAN 80% OF THE DESIGN COMPRESSIVE STRENGTH, THEN THE ELEMENT SHALL BE ACCEPTED. WHEN THE COMPRESSIVE STRENGTH OF THE CYLINDERS TESTED DOES NOT CONFORM TO THESE ACCEPTANCE CRITERIA, THE ACCEPTABILITY OF THE ELEMENT MAY BE DETERMINED AS DESCRIBED IN SECTION 6.1.4, BELOW.
      6.1.4. ACCEPTABILITY OF CORE TESTS - THE COMPRESSIVE STRENGTH OF THE CONCRETE IN A BRIDGE ELEMENT IS ACCEPTABLE WHEN THE AVERAGE CORE TEST STRENGTH IS EQUAL TO OR GREATER THAN THE DESIGN CONCRETE STRENGTH. WHEN THE COMPRESSIVE STRENGTH OF A CORE TESTED IS LESS THAN THE DESIGN CONCRETE STRENGTH, THE PRECAST ELEMENT FROM WHICH THAT CORE WAS TAKEN MAY BE RE-CORED. WHEN THE COMPRESSIVE STRENGTH OF THE RE-CORE IS EQUAL TO OR GREATER THAN THE DESIGN CONCRETE STRENGTH, THE COMPRESSIVE STRENGTH OF THE CONCRETE IN THAT BRIDGE ELEMENT IS ACCEPTABLE.
         6.1.4.1. WHEN THE COMPRESSIVE STRENGTH OF ANY RECORE IS LESS THAN THE DESIGN CONCRETE STRENGTH, THE PRECAST ELEMENT FROM WHICH THAT CORE WAS TAKEN SHALL BE REJECTED.
         6.1.4.2. PLUGGING CORE HOLES - THE CORE HOLES SHALL BE PLUGGED AND SEALED BY THE MANUFACTURER IN A MANNER SUCH THAT THE ELEMENTS WILL MEET ALL OF THE TEST REQUIREMENTS OF THIS SPECIFICATION. PRECAST ELEMENTS SO SEALED SHALL BE CONSIDERED SATISFACTORY FOR USE.
         6.1.4.3. TEST EQUIPMENT - EVERY MANUFACTURER FURNISHING PRECAST ELEMENTS UNDER THIS SPECIFICATION SHALL FURNISH ALL FACILITIES AND PERSONNEL NECESSARY TO CARRY OUT THE TEST REQUIRED.
   6.2. INSPECTION - THE QUALITY OF MATERIALS, THE PROCESS OF MANUFACTURE, AND THE FINISHED PRECAST ELEMENTS SHALL BE SUBJECT TO INSPECTION BY THE PURCHASER.

7. JOINTS
   THE BRIDGE UNITS SHALL BE PRODUCED WITH FLAT BUTT ENDS. THE ENDS OF THE BRIDGE UNITS SHALL BE SUCH THAT WHEN THE SECTIONS ARE LAID TOGETHER THEY WILL MAKE A CONTINUOUS LINE WITH A SMOOTH INTERIOR FREE OF APPRECIABLE IRREGULARITIES, ALL COMPATIBLE WITH THE PERMISSIBLE VARIATIONS IN SECTION 5, ABOVE. THE JOINT WIDTH BETWEEN ADJACENT PRECAST UNITS SHALL NOT EXCEED ¾".

8. WORKMANSHIP/ FINISH
   THE BRIDGE UNITS, WINGWALLS, AND HEADWALLS SHALL BE SUBSTANTIALLY FREE OF FRACTURES. THE ENDS OF THE BRIDGE UNITS SHALL BE NORMAL TO THE WALLS AND CENTERLINE OF THE BRIDGE SECTION, WITHIN THE LIMITS OF THE VARIATIONS GIVEN IN SECTION 5, ABOVE, EXCEPT WHERE BEVELED ENDS ARE SPECIFIED. THE FACES OF THE WINGWALLS AND HEADWALLS SHALL BE PARALLEL TO EACH OTHER, WITHIN THE LIMITS OF VARIATIONS GIVEN IN SECTION 5, ABOVE. THE SURFACE OF THE PRECAST ELEMENTS SHALL BE A SMOOTH STEEL FORM OR TROWELED SURFACE. TRAPPED AIR POCKETS CAUSING SURFACE DEFECTS SHALL BE CONSIDERED AS PART OF A SMOOTH, STEEL FORM FINISH.

9. REPAIRS
   PRECAST ELEMENTS MAY BE REPAIRED, IF NECESSARY, BECAUSE OF IMPERFECTIONS IN MANUFACTURE OR HANDLING DAMAGE AND WILL BE ACCEPTABLE IF, IN THE OPINION OF THE PURCHASER, THE REPAIRS ARE SOUND, PROPERLY FINISHED AND CURED, AND THE REPAIRED SECTION CONFORMS TO THE REQUIREMENTS OF THIS SPECIFICATION.

10. REJECTION
    THE PRECAST ELEMENTS SHALL BE SUBJECT TO REJECTION ON ACCOUNT OF ANY OF THE SPECIFICATION REQUIREMENTS. INDIVIDUAL PRECAST ELEMENTS MAY BE REJECTED BECAUSE OF ANY OF THE FOLLOWING:
    10.1. FRACTURES OR CRACKS PASSING THROUGH THE WALL, EXCEPT FOR A SINGLE END CRACK THAT DOES NOT EXCEED ONE HALF THE THICKNESS OF THE WALL.
    10.2. DEFECTS THAT INDICATE PROPORTIONING, MIXING, AND MOLDING NOT IN COMPLIANCE WITH SECTION 4 OF THESE SPECIFICATIONS.
    10.3. HONEYCOMBED OR OPEN TEXTURE.
    10.4. DAMAGED ENDS, WHERE SUCH DAMAGE WOULD PREVENT MAKING A SATISFACTORY JOINT.

11. MARKING
    EACH BRIDGE UNIT SHALL BE CLEARLY MARKED BY WATERPROOF PAINT. THE FOLLOWING SHALL BE SHOWN ON THE INSIDE OF THE VERTICAL LEG OF THE BRIDGE SECTION:
    BRIDGE SPAN x BRIDGE RISE
    DATE OF MANUFACTURE
    NAME OR TRADEMARK OF THE MANUFACTURER

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH® BRIDGE SOLUTIONS
www.contechES.com
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CON/SPAN® BRIDGE SYSTEMS
CONTECH PROPOSAL DRAWING

KENTUCKY TRANSPORTATION CABINET STANDARD DETAILS

FRANKFORT, KENTUCKY

PROJECT No.:	SEQ. No.:	DATE:
	001	6/18/2012
DESIGNED: PAC	DRAWN: JCH	
CHECKED: DLW	APPROVED:	
SHEET NO.: CT8 OF CT9		

SPECIFICATIONS FOR MANUFACTURE AND INSTALLATION OF CON/SPAN® BRIDGE SYSTEMS (CONT'D)

12. INSTALLATION PREPARATION
TO ENSURE CORRECT INSTALLATION OF THE PRECAST CONCRETE BRIDGE SYSTEM, CARE AND CAUTION MUST BE EXERCISED IN FORMING THE SUPPORT AREAS FOR BRIDGE UNITS, HEADWALL, AND WINGWALL ELEMENTS. EXERCISING SPECIAL CARE WILL FACILITATE THE RAPID INSTALLATION OF THE PRECAST COMPONENTS.

12.1. FOOTINGS
DO NOT OVER EXCAVATE FOUNDATIONS UNLESS DIRECTED BY SITE SOIL ENGINEER TO REMOVE UNSUITABLE SOIL.

THE SITE SOILS ENGINEER SHALL CERTIFY THAT THE BEARING CAPACITY MEETS OR EXCEEDS THE FOOTING DESIGN REQUIREMENTS, PRIOR TO THE CONTRACTOR POURING OF THE FOOTINGS.

THE BRIDGE UNITS AND WINGWALLS SHALL BE INSTALLED ON EITHER PRECAST OR CAST-IN-PLACE CONCRETE FOOTINGS. THE SIZE AND ELEVATION OF THE FOOTINGS SHALL BE AS DESIGNED BY THE ENGINEER. A KEYWAY SHALL BE FORMED IN THE TOP SURFACE OF THE BRIDGE FOOTING AS SPECIFIED ON THE PLANS. NO KEYWAY IS REQUIRED IN THE WINGWALL FOOTINGS, UNLESS OTHERWISE SPECIFIED ON THE PLANS.

THE FOOTINGS SHALL BE GIVEN A SMOOTH FLOAT FINISH AND SHALL REACH A COMPRESSIVE STRENGTH OF 2,000 PSI BEFORE PLACEMENT OF THE BRIDGE AND WINGWALL ELEMENTS. BACKFILLING SHALL NOT BEGIN UNTIL THE FOOTING HAS REACHED THE FULL DESIGN COMPRESSIVE STRENGTH WITHOUT WRITTEN APPROVAL FROM CONTECH® BRIDGE SOLUTIONS.

THE FOOTING SURFACE SHALL BE CONSTRUCTED IN ACCORDANCE WITH GRADES SHOWN ON THE PLANS. WHEN TESTED WITH A 10'-0" STRAIGHT EDGE, THE SURFACE SHALL NOT VARY MORE THAN ¼" IN 10'-0".

IF A PRECAST CONCRETE FOOTING IS USED, THE CONTRACTOR SHALL PREPARE A 4" THICK BASE LAYER OF COMPACTED GRANULAR MATERIAL THE FULL WIDTH OF THE FOOTING PRIOR TO PLACING THE PRECAST FOOTING.

THE FOUNDATIONS FOR PRECAST CONCRETE BRIDGE ELEMENTS AND WINGWALLS MUST BE CONNECTED BY REINFORCEMENT TO FORM ONE MONOLITHIC BODY. EXPANSION JOINTS SHALL NOT BE USED.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONSTRUCTION OF THE FOUNDATIONS PER THE PLANS AND SPECIFICATIONS.

13. INSTALLATION
13.1. GENERAL - THE INSTALLATION OF THE PRECAST CONCRETE ELEMENTS SHALL BE AS EXPLAINED IN THE PUBLICATION CON/SPAN BRIDGE SYSTEMS INSTALLATION HANDBOOK.
13.1.1. LIFTING - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT A CRANE OF THE CORRECT LIFTING CAPACITY IS AVAILABLE TO HANDLE THE PRECAST CONCRETE UNITS. THIS CAN BE ACCOMPLISHED BY USING THE WEIGHTS GIVEN FOR THE PRECAST CONCRETE COMPONENTS AND BY DETERMINING THE LIFTING REACH FOR EACH CRANE UNIT. SITE CONDITIONS MUST BE CHECKED WELL IN ADVANCE OF SHIPPING TO ENSURE PROPER CRANE LOCATION AND TO AVOID ANY LIFTING RESTRICTIONS. THE LIFT ANCHORS OR HOLES PROVIDED IN EACH UNIT ARE THE ONLY MEANS TO BE USED TO LIFT THE ELEMENTS. THE PRECAST CONCRETE ELEMENTS MUST NOT BE SUPPORTED OR RAISED BY OTHER MEANS THAN THOSE GIVEN IN THE MANUALS AND DRAWINGS WITHOUT WRITTEN APPROVAL FROM CONTECH® BRIDGE SOLUTIONS.
13.1.2. CONSTRUCTION EQUIPMENT WEIGHT RESTRICTIONS - IN NO CASE SHALL EQUIPMENT OPERATING IN EXCESS OF THE DESIGN LOAD (HL-93) BE PERMITTED OVER THE BRIDGE UNITS UNLESS APPROVED BY CONTECH® BRIDGE SOLUTIONS.
13.1.2.1. IN THE IMMEDIATE AREA OF THE BRIDGE UNITS, THE FOLLOWING RESTRICTIONS FOR THE USE OF HEAVY CONSTRUCTION MACHINERY DURING BACKFILLING OPERATIONS APPLY:
- NO CONSTRUCTION EQUIPMENT SHALL CROSS THE BARE PRECAST CONCRETE BRIDGE UNIT.
- AFTER THE COMPACTED FILL LEVEL HAS REACHED A MINIMUM OF 4" OVER THE CROWN OF THE BRIDGE, CONSTRUCTION EQUIPMENT WITH A WEIGHT OF LESS THAN 10 TONS MAY CROSS THE BRIDGE.
- AFTER THE COMPACTED FILL LEVEL HAS REACHED A MINIMUM OF 1'-0" OVER THE CROWN OF THE BRIDGE, CONSTRUCTION EQUIPMENT WITH A WEIGHT OF LESS THAN 30 TONS MAY CROSS THE BRIDGE.
- AFTER THE COMPACTED FILL LEVEL HAS REACHED THE DESIGN COVER, OR 2'-0" MINIMUM, OVER THE CROWN OF THE PRECAST CONCRETE BRIDGE, CONSTRUCTION EQUIPMENT WITHIN THE DESIGN LOAD LIMITS FOR THE ROAD MAY CROSS THE PRECAST CONCRETE BRIDGE.

13.2. LEVELING PAD/SHIMS - THE BRIDGE UNITS AND WINGWALLS SHALL BE SET ON MASONITE OR STEEL SHIMS MEASURING 5" x 5", MINIMUM, UNLESS SHOWN OTHERWISE ON THE PLANS. A MINIMUM GAP OF ½" SHALL BE PROVIDED BETWEEN THE FOOTING AND THE BOTTOM OF THE BRIDGE'S VERTICAL LEGS OR THE BOTTOM OF THE WINGWALL. ALSO, A SUPPLY OF ¼", ½" & ⅜" THICK STEEL OR MASONITE SHIMS FOR VARIOUS SHIMMING PURPOSES SHOULD BE ON SITE.
13.3. PLACEMENT OF BRIDGE UNITS - THE BRIDGE UNITS SHALL BE PLACED AS SHOWN ON THE ENGINEER'S PLAN DRAWINGS. SPECIAL CARE SHALL BE TAKEN IN SETTING THE ELEMENTS TO THE TRUE LINE AND GRADE. THE JOINT WIDTH BETWEEN ADJACENT PRECAST UNITS SHALL NOT EXCEED ¾".

13.4. IT IS IMPERATIVE THAT ANY LATERAL SPREADING OF THE BRIDGE ELEMENTS BE AVOIDED DURING AND AFTER THEIR PLACEMENT. GENERALLY, HORIZONTAL CABLE TIES OR TIE RODS ARE SHIPPED IN THE LARGER BRIDGE ELEMENTS TO PREVENT THIS SPREADING. CABLE TIES/TIE RODS SHALL NOT BE REMOVED UNTIL BRIDGE UNITS ARE GROUTED AND GROUT HAS CURED. IF, HOWEVER, DUE TO SITE RESTRICTIONS, THESE CABLE TIES/TIE RODS MUST BE REMOVED PRIOR TO PLACEMENT OF THE BRIDGE ELEMENTS, THE CONTRACTOR MUST NOTIFY CONTECH (MANUFACTURER) AND REQUEST A SUGGESTED INSTALLATION PROCEDURE.

IN ADDITION, IF THE CABLE TIES/TIE RODS MUST BE REMOVED PRIOR TO SETTING ARCH UNITS, THE FOLLOWING QUALITY CONTROL PROCEDURE MUST BE FOLLOWED:
1) FIND "MEASURED SPAN" UPON ARCH UNIT'S DELIVERY TO SITE, PRIOR TO LIFTING FROM TRUCK AND REMOVING CABLE TIES/TIE RODS. "MEASURED SPAN" SHALL BE THE AVERAGE OF (3) SPAN MEASUREMENTS ALONG THE LAY LENGTH OF THE ARCH UNIT.

2) AFTER SETTING OF BRIDGE UNIT ON THE FOUNDATION, VERIFY THE SPAN. THIS "INSTALLED SPAN MEASUREMENT" SHALL NOT EXCEED THE MAXIMUM OF
A) THE NOMINAL SPAN +½" OR
B) THE "MEASURED SPAN".
IF THE "INSTALLED SPAN MEASUREMENT" EXCEEDS THIS AMOUNT, THE ARCH UNIT SHALL BE LIFTED AND RE-SET UNTIL THE "INSTALLED SPAN MEASUREMENT" MEETS THE LIMITS.

13.5. PLACEMENT OF WINGWALLS & HEADWALLS - THE WINGWALLS AND HEADWALLS SHALL BE PLACED AS SHOWN ON THE PLAN DRAWINGS. SPECIAL CARE SHALL BE TAKEN IN SETTING THE ELEMENTS TO THE TRUE LINE AND GRADE.
13.6. WATERPROOFING/JOINT PROTECTION AND SUBSURFACE DRAINAGE
13.6.1. EXTERNAL PROTECTION OF JOINTS - THE BUTT JOINT MADE BY TWO ADJOINING BRIDGE UNITS SHALL BE COVERED WITH A ⅛" x 13½" PREFORMED BITUMINOUS JOINT SEALANT AND A MINIMUM OF A 9" WIDE JOINT WRAP. THE SURFACE SHALL BE FREE OF DIRT BEFORE APPLYING THE JOINT MATERIAL. A PRIMER COMPATIBLE WITH THE JOINT WRAP TO BE USED SHALL BE APPLIED FOR A MINIMUM WIDTH OF 9" ON EACH SIDE OF THE JOINT. THE EXTERNAL WRAP SHALL BE EITHER EZ-WRAP RUBBER BY PRESS-SEAL GASKET CORPORATION, SEAL WRAP BY MAR MAC MANUFACTURING CO. INC. OR APPROVED EQUAL. THE JOINT SHALL BE COVERED CONTINUOUSLY FROM THE BOTTOM OF ONE BRIDGE SECTION LEG, ACROSS THE TOP OF THE BRIDGE AND TO THE OPPOSITE BRIDGE SECTION LEG. ANY LAPS THAT RESULT IN THE JOINT WRAP SHALL BE A MINIMUM OF 6" LONG WITH THE OVERLAP RUNNING DOWNHILL.
13.6.2. IN ADDITION TO THE JOINTS BETWEEN BRIDGE UNITS, THE JOINT BETWEEN THE END BRIDGE UNIT AND THE HEADWALL SHALL ALSO BE SEALED AS DESCRIBED ABOVE. IF PRECAST WINGWALLS ARE USED, THE JOINT BETWEEN THE END BRIDGE UNIT AND THE WINGWALL SHALL BE SEALED WITH A 2'-0" STRIP OF FILTER FABRIC. ALSO, IF LIFT HOLES ARE FORMED IN THE BRIDGE UNITS, THEY SHALL BE PRIMED AND COVERED WITH A 9" x 9" SQUARE OF JOINT WRAP.
13.6.3. DURING THE BACKFILLING OPERATION, CARE SHALL BE TAKEN TO KEEP THE JOINT WRAP IN ITS PROPER LOCATION OVER THE JOINT.
13.6.4. SUBSOIL DRAINAGE SHALL BE AS DIRECTED BY THE ENGINEER.

13.7. GROUTING
13.7.1. GROUTING SHALL NOT BE PERFORMED WHEN TEMPERATURES ARE EXPECTED TO GO BELOW 35° FOR A PERIOD OF 72 HOURS. FILL THE BRIDGE-FOUNDATION KEYWAY WITH CEMENT GROUT (PORTLAND CEMENT AND WATER OR CEMENT MORTAR COMPOSED OF PORTLAND CEMENT, SAND AND WATER) WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3000 PSI. VIBRATE AS REQUIRED TO ENSURE THAT THE ENTIRE KEY AROUND THE BRIDGE ELEMENT IS COMPLETELY FILLED. IF BRIDGE ELEMENTS HAVE BEEN SET WITH TEMPORARY TIES (CABLES, BARS, ETC.) GROUT MUST ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 1500 PSI BEFORE TIES MAY BE REMOVED.
13.7.2. ALL GROUT SHALL HAVE A MAXIMUM AGGREGATE SIZE OF ¼".
13.7.3. LIFTING AND ERECTION ANCHOR RECESSES SHALL BE FILLED WITH GROUT.
13.8. BACKFILL
13.8.1. DO NOT PERFORM BACKFILLING DURING WET OR FREEZING WEATHER.
13.8.2. NO BACKFILL SHALL BE PLACED AGAINST ANY STRUCTURAL ELEMENTS UNTIL THEY HAVE BEEN APPROVED BY THE ENGINEER.
13.8.3. BACKFILL SHALL BE CONSIDERED AS ALL REPLACED EXCAVATION AND NEW EMBANKMENT ADJACENT TO THE PRECAST CONCRETE ELEMENTS. THE PROJECT CONSTRUCTION AND MATERIAL SPECIFICATIONS, WHICH INCLUDE THE SPECIFICATIONS FOR EXCAVATION FOR STRUCTURES AND ROADWAY EXCAVATION AND EMBANKMENT CONSTRUCTION, SHALL APPLY EXCEPT AS MODIFIED IN THIS SECTION.
13.8.4. BACKFILL ZONES:
- IN-SITU SOIL
- ZONE A: CONSTRUCTED EMBANKMENT OR OVERFILL.
- ZONE B: FILL THAT IS DIRECTLY ASSOCIATED WITH PRECAST CONCRETE BRIDGE INSTALLATION.
- ZONE C: ROAD STRUCTURE.

13.8.5. REQUIRED BACKFILL PROPERTIES
13.8.5.1. IN-SITU SOIL - NATURAL GROUND IS TO BE SUFFICIENTLY STABLE TO ALLOW EFFECTIVE SUPPORT TO THE PRECAST CONCRETE BRIDGE UNITS. AS A GUIDE, THE EXISTING NATURAL GROUND SHOULD BE OF SIMILAR QUALITY AND DENSITY TO ZONE B MATERIAL FOR MINIMUM LATERAL DIMENSION OF ONE BRIDGE SPAN OUTSIDE OF THE BRIDGE FOOTING.
13.8.5.2. ZONE A - ZONE A REQUIRES FILL MATERIAL WITH SPECIFICATIONS AND COMPACTING PROCEDURES EQUAL TO THAT FOR NORMAL ROAD EMBANKMENTS.
13.8.5.3. ZONE B - GENERALLY, SOILS SHALL BE REASONABLY FREE OF ORGANIC MATTER, AND, NEAR CONCRETE SURFACES, FREE OF STONES LARGER THAN 3" IN DIAMETER SEE CHARTS FOR DETAILED DESCRIPTIONS OF ACCEPTABLE SOILS.
13.8.5.4. ZONE C - ZONE C IS THE ROAD SECTION OF GRAVEL, ASPHALT OR CONCRETE BUILT IN COMPLIANCE WITH LOCAL ENGINEERING PRACTICES.
13.8.5.5. GEOTECHNICAL ENGINEER SHALL REVIEW GRADATIONS OF ALL INTERFACING MATERIALS AND, IF NECESSARY, RECOMMEND GEOTEXTILE FILTER FABRIC (PROVIDED BY CONTRACTOR)

13.8.6. PLACING AND COMPACTING BACKFILL
DUMPING FOR BACKFILLING IS NOT ALLOWED ANY NEARER THAN 3'-0" FROM THE BRIDGE LEG.

THE FILL MUST BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING 8". THE MAXIMUM DIFFERENCE IN THE SURFACE LEVELS OF THE FILL ON OPPOSITE SIDES OF THE BRIDGE MUST NOT EXCEED 2'-0".

THE FILL BEHIND WINGWALLS MUST BE PLACED AT THE SAME TIME AS THAT OF THE BRIDGE FILL. IT MUST BE PLACED IN PROGRESSIVELY PLACED HORIZONTAL LAYERS NOT EXCEEDING 8" PER LAYER.

THE BACKFILL OF ZONE B SHALL BE COMPACTED TO A MINIMUM DENSITY OF 95% OF THE STANDARD PROCTOR, AS REQUIRED BY AASHTO T-99.

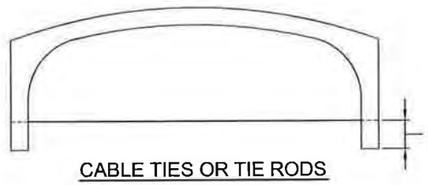
SOIL WITHIN 1'-0" OF CONCRETE SURFACES SHOULD BE HAND-COMPACTED. ELSEWHERE, USE OF ROLLERS IS ACCEPTABLE. IF VIBRATING ROLLER-COMPACTORS ARE USED, THEY SHOULD NOT BE STARTED OR STOPPED WITHIN ZONE B AND THE VIBRATION FREQUENCY SHOULD BE AT LEAST 30 REVOLUTIONS PER SECOND.

THE BACKFILL MATERIAL AND COMPACTING BEHIND WINGWALLS SHOULD SATISFY THE CRITERIA FOR THE BRIDGE BACKFILL, ZONE B.

BACKFILL AGAINST A WATERPROOFED SURFACE SHALL BE PLACED CAREFULLY TO AVOID DAMAGE TO THE WATERPROOFING MATERIAL.
13.8.7. BRIDGE UNITS
FOR FILL HEIGHTS OVER 12'-0", NO BACKFILLING MAY BEGIN UNTIL A BACKFILL COMPACTION TESTING PLAN HAS BEEN COORDINATED WITH AND APPROVED BY CONTECH® BRIDGE SOLUTIONS. COST OF THE BACKFILL COMPACTION TESTING SHALL BE INCLUDED IN THE COST OF THE PRECAST UNITS. THIS INCLUDED COST APPLIES ONLY TO PROJECTS WITH FILL HEIGHTS OVER 12'-0" (AS MEASURED FROM TOP CROWN OF BRIDGE TO FINISHED GRADE).
13.8.8. WINGWALLS
BACKFILL IN FRONT OF WINGWALLS SHALL BE CARRIED TO GROUND LINES SHOWN IN THE PLANS.
13.8.9. MONITORING
THE CONTRACTOR SHALL CHECK SETTLEMENTS AND HORIZONTAL DISPLACEMENT OF FOUNDATION TO ENSURE THAT THEY ARE WITHIN THE ALLOWABLE LIMIT PROVIDED BY THE ENGINEER. THESE MEASUREMENTS SHOULD GIVE AN INDICATION OF THE SETTLEMENTS AND DEFORMATIONS ALONG THE LENGTH OF THE FOUNDATIONS.

THE FIRST MEASUREMENT ROW SHOULD TAKE PLACE AFTER THE ERECTION OF ALL PRECAST BRIDGE SYSTEM ELEMENTS, A SECOND AFTER COMPLETION OF BACKFILLING, AND A THIRD BEFORE OPENING OF THE BRIDGE TO TRAFFIC. FURTHER MEASUREMENTS MAY BE MADE ACCORDING TO LOCAL CONDITIONS.

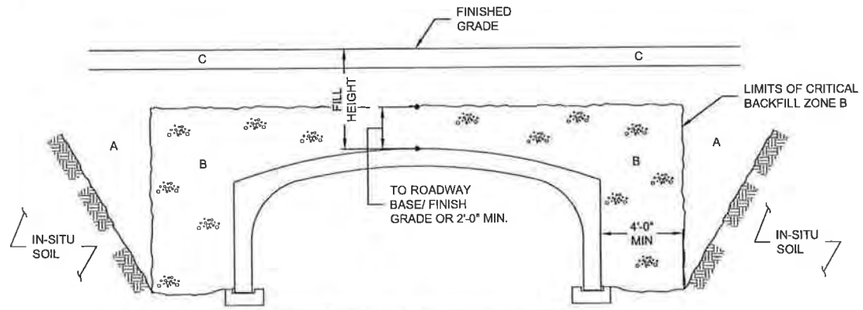
THE MAXIMUM DIFFERENCE IN VERTICAL DISPLACEMENTS 'V' SHOULD NOT EXCEED 1" ALONG THE LENGTH OF ONE FOUNDATION.



CABLE TIES OR TIE RODS
(> 24'-0" SPAN)

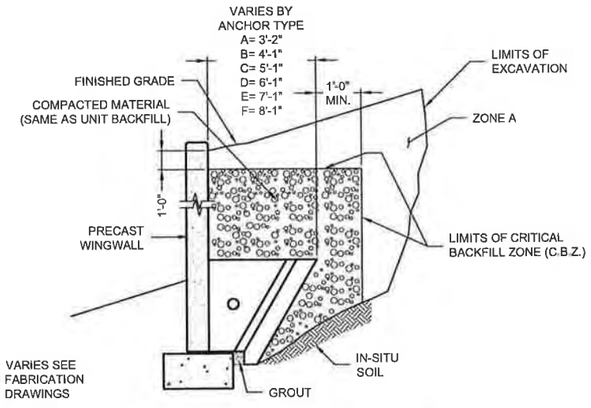
ACCEPTABLE SOILS FOR USE IN ZONE B BACKFILL

TYPICAL USCS MATERIALS	AASHTO GROUP	AASHTO SUBGROUP	PERCENT PASSING US SIEVE NO. #10	#40	#200	CHARACTER OF FRACTION PASSING NO. 40 SIEVE LIQUID LIMIT	PLASTICITY INDEX	SOIL DESRIPTION
GW, GP, SP	A1	A-1a	50 MAX	30 MAX	15 MAX		6 MAX	LARGELY GRAVEL BUT CAN INCLUDE SAND AND FINES
GM, SW, SP, SM		A-1b		50 MAX	25 MAX		6 MAX	GRAVELLY SAND OR GRADED SAND, MAY INCLUDE FINES
GM, SM, ML, SP, GP	A2	A-2-4			35 MAX	40 MAX	10 MAX	SANDS, GRAVELS WITH LOW-PLASTICITY SILT FINES
SC, GC, GM		A-2-5			35 MAX	41 MIN	10 MAX	SANDS, GRAVELS WITH PLASTIC SILT FINES
SP, SM, SW	A3			51 MIN	10 MAX		NON-PLASTIC	FINE SANDS
ML, SM, SC	A4				36 MIN	40 MAX	10 MAX	LOW-COMPRESSIBILTY SILTS



SPAN	FILL HEIGHT	ACCEPTABLE MATERIAL INSIDE ZONE B
≤ 24'-0"	≥ 12'-0"	A1, A3
≤ 24'-0"	< 12'-0"	A1, A2, A3, A4
> 24'-0"	ALL	A1, A3

BACKFILL REQUIREMENTS



WALL BACKFILL REQUIREMENTS

W:\ENGINEERING STANDARDS\ENGINEERING RESOURCE LIBRARY\DOT SPECIFICATIONS AND APPROVALS\KTCS-1-12 KENTUCKY TRANSPORTATION CABINET - CON-SPAN DETAILS2.DWG 6/18/2012 2:06 PM

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CONTECH PROPOSAL DRAWING

KENTUCKY TRANSPORTATION CABINET STANDARD DETAILS

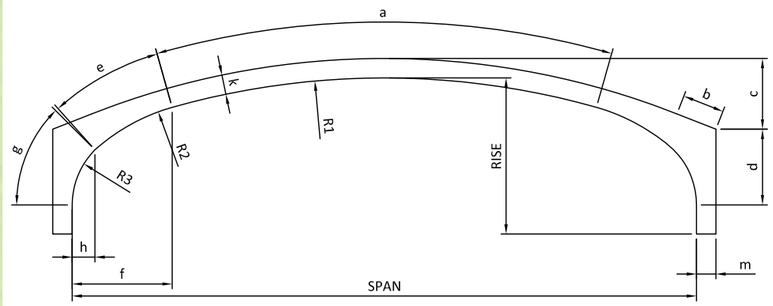
FRANKFORT, KENTUCKY

PROJECT No.:	SEQ. No.:	DATE:
	001	6/18/2012
DESIGNED: PAC	DRAWN: JCH	
CHECKED: DLW	APPROVED:	
SHEET NO.: CT9 OF CT9		

ECOSPAN ARCH SYSTEM DRAWINGS AND DETAILS

Arch-Box (AB) Series

Span	12.00'	14.00'	16.00'	20.00'	24.00'	28.00'	32.00'	36.00'	42.00'	48.00'	54.00'	60.00'	70.00'	80.00'
Main Arc Length, a	13.77'	15.77'	18.04'	18.04'	18.04'	30.71'	30.71'	30.71'	32.64'	45.58'	41.54'	41.54'	66.47'	75.97'
Main Arc Radius, R1	15.00'	15.00'	25.00'	25.00'	25.00'	40.00'	40.00'	40.00'	55.00'	55.00'	70.00'	70.00'	80.21'	91.67'
Flat Corner Length, b	0.00'	0.00'	0.00'	2.13'	4.26'	0.00'	2.15'	4.48'	0.00'	3.45'	0.00'	3.45'	0.00'	5.75'
Arch Drop, c	1.49'	1.49'	2.80'	2.68'	2.75'	2.84'	3.63'	4.48'	4.57'	4.12'	5.88'	7.26'	6.01'	6.87'
Corner to Springline, d	2.18'	2.18'	2.80'	2.68'	2.75'	3.76'	3.88'	3.91'	4.20'	5.94'	4.94'	5.24'	8.66'	9.90'
Second Arc Length, e	3.22'	3.22'	3.45'	3.45'	3.45'	4.57'	4.57'	4.57'	2.58'	5.82'	3.19'	7.68'	8.49'	9.70'
Second Arc Radius, R2	2.50'	2.50'	3.00'	3.00'	3.00'	10.00'	10.00'	10.00'	12.11'	27.57'	25.69'	25.64'	40.21'	45.95'
Second Arc Start Point, f	1.88'	1.88'	1.77'	1.77'	1.77'	5.23'	5.12'	4.99'	4.92'	7.92'	6.53'	9.53'	11.55'	13.20'
Third Arc Length, g	-	-	-	-	-	3.13'	3.13'	3.13'	5.31'	5.31'	6.90'	5.85'	7.74'	8.85'
Third Arc Radius, R3	-	-	-	-	-	4.00'	4.00'	4.00'	5.00'	5.00'	6.00'	6.00'	7.29'	8.33'
Third Arc Start Point, h	-	-	-	-	-	1.16'	1.16'	1.16'	2.58'	2.58'	3.55'	2.64'	3.76'	4.30'
Arch Thickness, k	8''	8''	10''	10''	10''	10''	12''	12''	12''	12''	14''	14''	16''	18''
Leg Thickness, m	8''	8''	10''	10''	10''	12''	12''	14''	14''	16''	16''	18''	20''	24''
Maximum Lay Length	8.00'	8.00'	8.00'	8.00'	8.00'	6.00'	6.00'	6.00'	6.00'	6.00'	4.00'	4.00'	5.00'	4.00'
Maximum Fill Height*	40'	30'	40'	35'	25'	15'	15'	12'	12'	10'	10'	10'	10'	10'



AB SERIES PRECAST
UNIT GEOMETRY

NOTE: 16' - 24' SPAN GEOMETRY USES ONLY 2 ARCS.

Variable-Radius (VR) Series

Nominal Span (Horizontal Length)	16.00'	20.00'	24.00'	28.00'	32.00'	36.00'	42.00'	48.00'	54.00'	60.00'	66.00'	72.00'	78.00'	84.00'
Vertical Length (Rise @ Springline)	6.83'	8.17'	9.50'	10.50'	11.50'	12.50'	13.50'	14.50'	16.50'	18.50'	20.50'	22.50'	24.5	26.5
Shape	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse	Ellipse
Thickness, t	8''	8''	8''	10''	10''	10''	10''	11''	12''	14''	14''	16''	16''	18''
Maximum Fill Height*	40'	30'	25'	15'	12'	10'	8'	8'	6'	6'	6'	6'	6'	6'

Single-Radius (SR) Series

Nominal Span (Diameter)	16.00'	20.00'	24.00'	30.00'	36.00'	42.00'	54.00'
Vertical Length (Radius)	8	10	12	15	18	21	27
Shape	Circle	Circle	Circle	Circle	Circle	Circle	Circle
Thickness, t	8	8	8	10	11	11	13
Maximum Fill Height*	50'	40'	35'	30'	25'	20'	15'

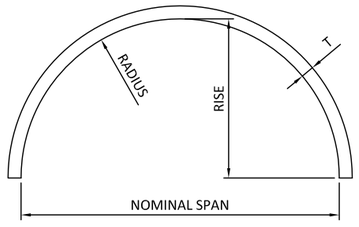
* Special Designs Available for Additional Fill Height

DESIGN NOTES

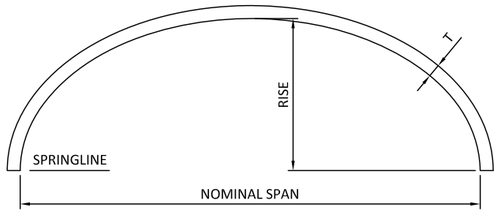
1. THIS STRUCTURE IS DESIGNED IN ACCORDANCE WITH THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, CURRENT EDITION WITH ALL INTERIMS.

DESIGN LOADS ARE AS FOLLOWS:
- BRIDGE UNITS: KYHL-93
- HEADWALLS: EARTH PRESSURE W/ LIVE LOAD SURCHARGE AS REQ'D
- WINGWALLS: EARTH PRESSURE W/ LIVE LOAD SURCHARGE AS REQ'D

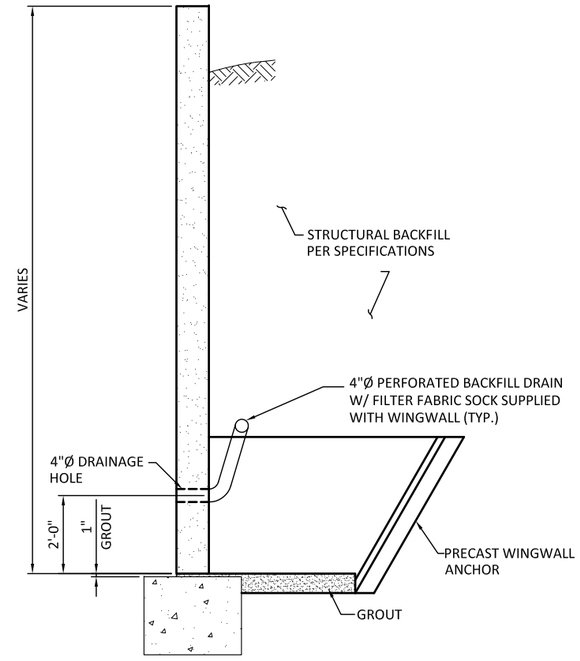
MANUFACTURER SHALL PROVIDE STRUCTURAL DESIGN CALCULATIONS SIGNED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF KENTUCKY WITH SHOP DRAWINGS FOR EACH PROJECT, FOR REVIEW AND APPROVAL BY KYTC.



SR SERIES PRECAST
UNIT GEOMETRY



VR SERIES PRECAST
UNIT GEOMETRY



TYPICAL WINGWALL SECTION

SYSTEM: ECOSPAN ARCH SYSTEMS

	DATE	DESCRIPTION	ENG
7			
6			
5			
4			
3			
2			
1	3/29/12	REVISED 54' AND 60' ARCH BOX GEOMETRY	TEN

KENTUCKY TRANSPORTATION CABINET
STANDARD BRIDGE SYSTEM DETAILS
page 38

LOCALE: STATE:

PROVIDED BY: API American Prefabricated Infrastructure™
AMERICAN PREFABRICATED INFRASTRUCTURE, LLC
937.848.1001

DESIGNED BY: STRUCTURESIGHT
9840 HAINES ROAD
WAYNESVILLE, OH 45068
937.401.2461
WWW.STRUCTURESIGHT.COM

PROJECT NUMBER:
DATE: 3/3/11
DESIGNED BY: JJV
DRAWN BY: JJV
CHECKED BY: JJV

Arch-Box (AB) Series

Nominal Bridge Unit Length:
16' - 24' Spans: 8'-0"
28' - 42' Spans: 6'-0"
48' - 80' Spans: 4'-0"

Waterway Area (SF)

Clear Rise \ Nominal Span	16'	20'	24'	28'	32'	36'	42'	48'	54'	60'	70'	80'
4'	55	65	72									
5'	71	85	95	111								
6'	87	105	119	138	153							
7'	103	125	143	167	184	197						
8'	119	145	167	195	216	232	271					
9'	135	165	191	223	248	268	313	340				
10'	151	185	215	251	280	304	355	387	437			
11'	167	205	239	279	315	340	397	435	491			
12'	183	225	263	307	344	376	439	483	545	575	647	704
13'	199	245	287	335	376	412	481	531	599	635	717	783
14'	215	265	311	363	408	448	523	579	653	695	787	862
15'	231	285	335	391	440	484	565	627	707	755	857	942

Indicates twin-leaf installation

Variable Radius (VR) Series

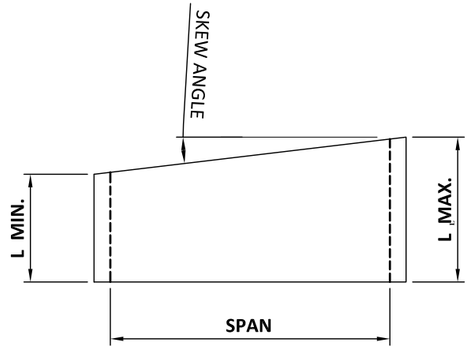
Nominal Bridge Unit Length:
16' - 24' Spans: 8'-0"
28' - 66' Spans: 6'-0"
72' - 84' Spans: 4'-0"

Waterway Area (SF)

Clear Rise \ Nominal Span	16'	20'	24'	28'	32'	36'	42'	48'	54'	60'	66'	72'	78'	84'
4'	43	67												
5'	57	86												
6'	73	105	96	108										
7'	89	125	120	134	148	197								
8'	105	145	143	161	178	232	271							
9'	121	165	167	188	209	268	313							
10'	137	185	191	216	240	304	355	333						
11'	153	205	215	230	272	340	397	379						
12'	169	225	239	258	304	376	439	427	484					
13'	185	245	263	286	336	412	481	475	537					
14'	201	265	287	314	368	448	523	523	590	629				
15'	217	285	311	342	400	484	565	571	643	688				
16'	233	305	335	370	432	520	607	619	697	747	798			
17'	249	325	359	398	464	556	649	667	751	807	863	922		
18'	265	345	383	426	496	592	691	715	805	867	928	993		
19'	281	365	407	454	528	628	733	763	859	927	994	1064	1120	
20'	297	385	431	482	560	664	775	811	913	987	1060	1136	1197	
21'	313	405	455	510	592	700	817	859	967	1041	1114	1208	1274	1337
22'	329	425	479	538	624	736	859	907	1021	1095	1168	1280	1352	1420
23'	345	445	503	566	656	772	901	955	1075	1149	1222	1334	1430	1504
24'	361	465	527	594	688	808	943	1003	1129	1203	1276	1388	1508	1588
25'	377	485	551	622	720	844	985	1051	1183	1257	1330	1442	1562	1672
26'	393	505	575	650	752	880	1027	1099	1237	1311	1384	1496	1616	1756

Indicates twin-leaf installation

Maximum Skew			
Span	L_L Max.	Max. Skew	L_S Min.
16'	7.75'	23.3°	2'
20'	7.75'	20.6°	2'
24'	7.75'	18.0°	2'
28'	5.75'	14.9°	2'
32'	5.75'	12.6°	2'
36'	5.75'	7.1°	2'
42'	5.75'	6.3°	2'
48'	3.75'	5.6°	2.5'
60'	N/A	N/A	N/A
70'	N/A	N/A	N/A
80'	N/A	N/A	N/A



SKEWED UNIT PLAN

Single Radius (SR) Series

Nominal Bridge Unit Length:
16' - 24' Spans: 8'-0"
30' - 54' Spans: 6'-0"

Waterway Area (SF)

Clear Rise \ Nominal Span	16'	20'	24'	30'	36'	42'	54'
4'	55	65	72				
5'	71	85	95	111			
6'	87	105	119	138	153		
7'	103	125	143	167	184		
8'	119	145	167	195	216	271	
9'	135	165	191	223	248	313	340
10'	151	185	215	251	280	355	387
11'	167	205	239	279	315	397	435
12'	183	225	263	307	344	439	483
13'	199	245	287	335	376	481	531
14'	215	265	311	363	408	523	579
15'	231	285	335	391	440	565	627

Indicates twin-leaf installation

SYSTEM: ECOSPAN ARCH SYSTEMS

	DATE	DESCRIPTION	ENG
7			
6			
5			
4			
3			
2			
1	3/29/12	REVISED 54' AND 60' ARCH BOX GEOMETRY	TEN

KENTUCKY TRANSPORTATION CABINET
STANDARD BRIDGE SYSTEM DETAILS
page 39

LOCALE: STATE:

PROVIDED BY: API American Prefabricated Infrastructure™
AMERICAN PREFABRICATED INFRASTRUCTURE, LLC
937.848.1001

DESIGNED BY: STRUCTURESIGHT
9840 HAINES ROAD
WAYNESVILLE, OH 45068
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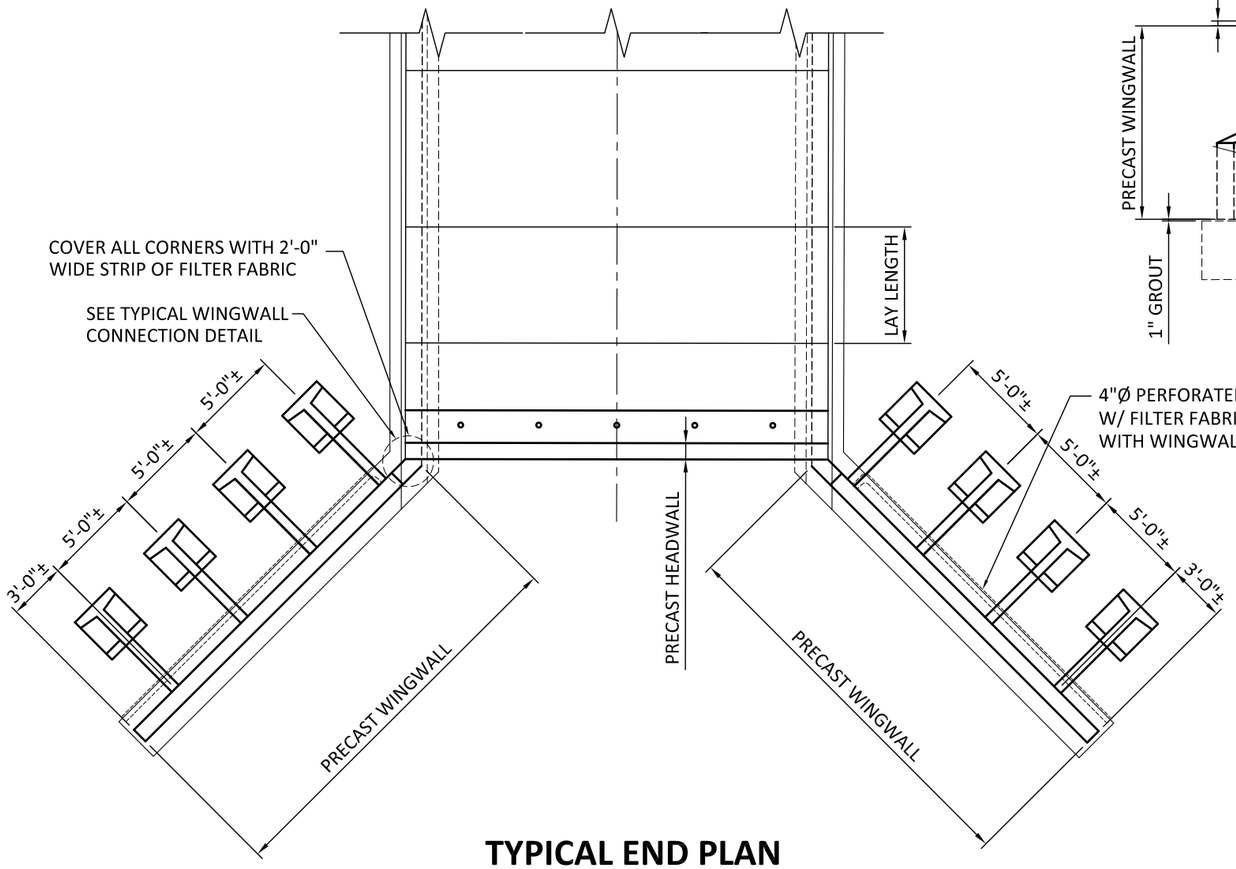
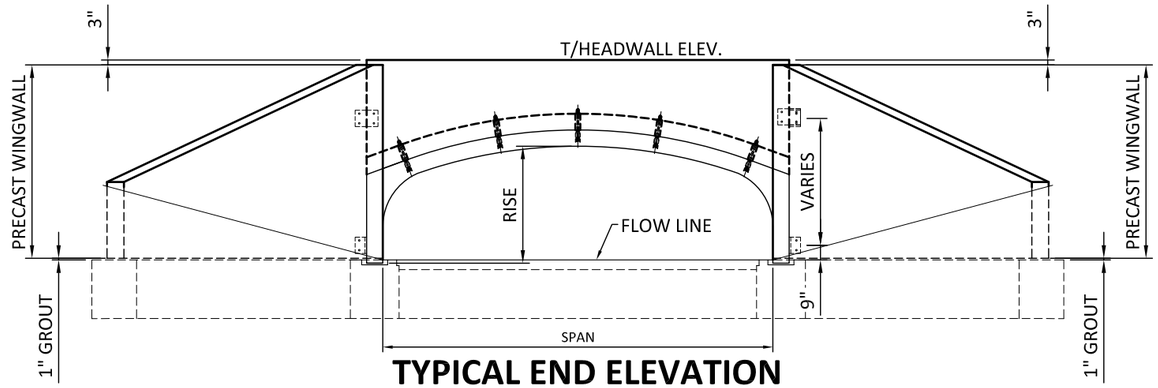
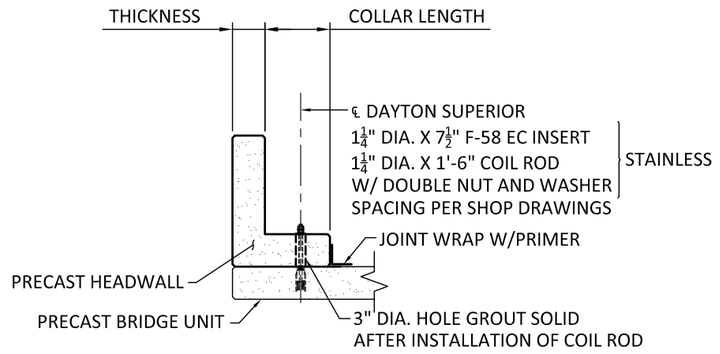


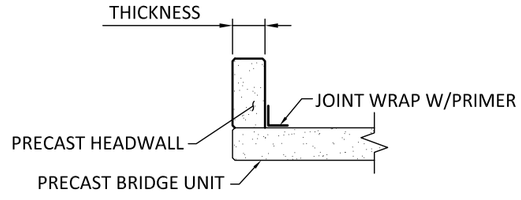
TYPICAL END PLAN



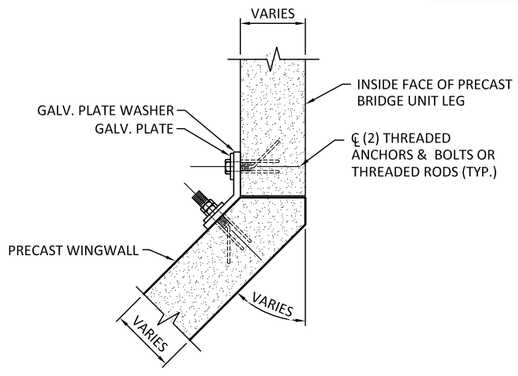
TYPICAL END ELEVATION



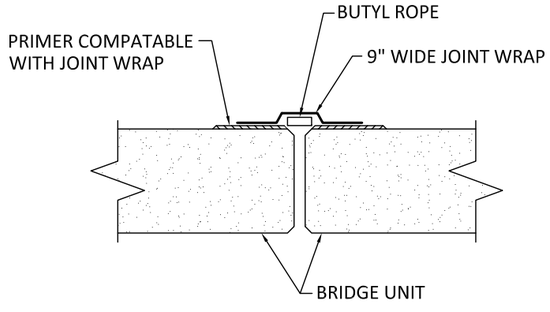
TYPICAL DETACHED HEADWALL DETAIL



TYPICAL ATTACHED HEADWALL DETAIL



TYPICAL WINGWALL CONNECTION DETAIL



BRIDGE JOINT SEAL DETAIL

SYSTEM: ECOSPAN ARCH SYSTEMS

	DATE	DESCRIPTION	ENG
7			
6			
5			
4			
3			
2			
1	3/29/12	REVISED 54' AND 60' ARCH BOX GEOMETRY	TEN

KENTUCKY TRANSPORTATION CABINET
STANDARD BRIDGE SYSTEM DETAILS
page 40

LOCALE: STATE:

PROVIDED BY: API American Prefabricated Infrastructure ™
AMERICAN PREFABRICATED INFRASTRUCTURE, LLC
937.848.1001

DESIGNED BY: STRUCTURESIGHT
9840 HAINES ROAD
WAYNESVILLE, OH 45068
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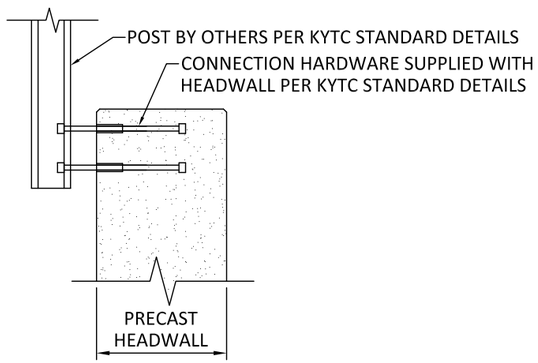
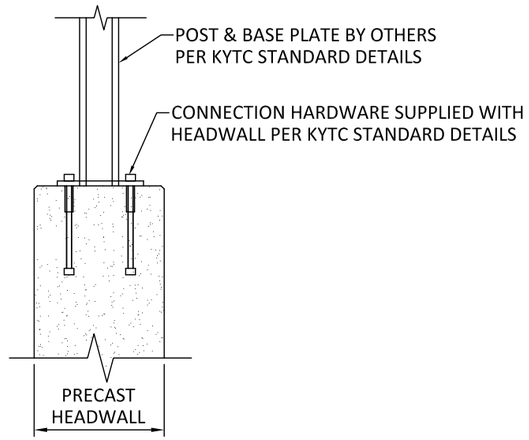
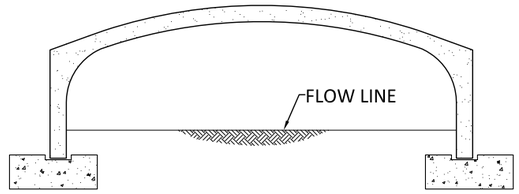


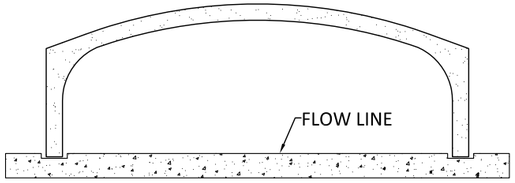
SIDE-MOUNTED POST CONNECTION



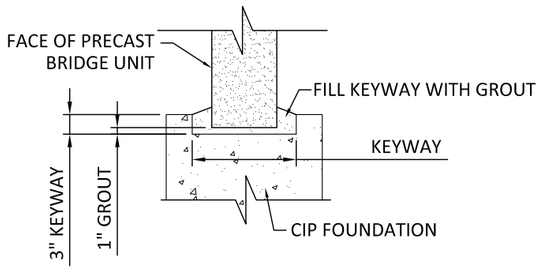
TOP-MOUNTED POST CONNECTION



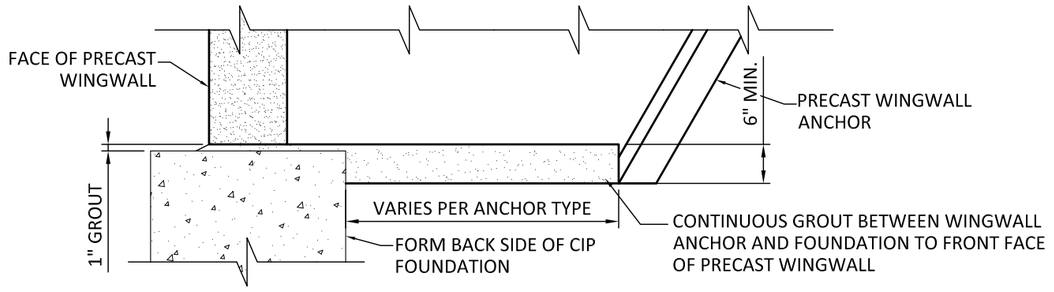
STRIP FOUNDATION ON NON-ERODIBLE ROCK



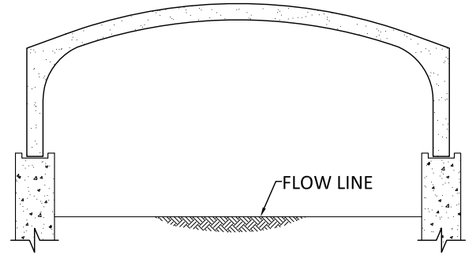
STRUCTURAL BASE SLAB FOUNDATION



BRIDGE UNIT GROUT DETAIL



WINGWALL GROUT DETAIL



PEDESTAL FOUNDATION

SYSTEM: ECOSPAN ARCH SYSTEMS

	DATE	DESCRIPTION	ENG
7			
6			
5			
4			
3			
2			
1	3/29/12	REVISED 54' AND 60' ARCH BOX GEOMETRY	TEN

KENTUCKY TRANSPORTATION CABINET
STANDARD BRIDGE SYSTEM DETAILS
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LOCALE: STATE:

PROVIDED BY: API American Prefabricated Infrastructure™
AMERICAN PREFABRICATED INFRASTRUCTURE, LLC
937.848.1001

DESIGNED BY: STRUCTURESIGHT
9840 HAINES ROAD
WAYNESVILLE, OH 45068
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PROJECT NUMBER:
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DESIGNED BY: JJV
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SPECIFICATIONS FOR THE MANUFACTURE AND DESIGN OF PRECAST THREE SIDED ARCH STRUCTURES, WINGWALLS AND HEADWALLS
(THE MORE STRINGENT OF THESE SPECIFICATIONS OR KYTC REQUIREMENTS SHALL GOVERN IN THE CASE OF CONFLICT)

1. DESCRIPTION

THESE SPECIFICATIONS ARE FOR A PRECAST THREE SIDED ARCH STRUCTURE, HEADWALLS AND WINGWALLS. PRECAST PIECES SHALL CONFORM TO THE MORE STRINGENT OF THESE SPECIFICATIONS OR ASTM C1504.

2. DESIGN

THE PRECAST UNITS ARE DESIGNED IN ACCORDANCE WITH THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS, CURRENT EDITION INCLUDING ALL INTERIM SPECIFICATIONS TO DATE.

CONSTRUCTION EQUIPMENT HEAVIER THAN A D-4 DOZER IS NOT ALLOWED OVER THE ARCH STRUCTURE UNTIL BACKFILL IS AT LEAST 1' OVER THE TOP OF THE ARCH. EQUIPMENT WITH AXLE WEIGHT OR TOTAL WEIGHT GREATER THAN THE DESIGN LOAD SHALL NOT BE OPERATED ON THE STRUCTURE WITHOUT WRITTEN APPROVAL FORM STRUCTURE SIGHT LLC.

3. MATERIAL - CONCRETE

ALL PRECAST ELEMENTS THAT ARE EXPOSED TO FREEZE - THAW SHALL BE AIR ENTRAINED AND COMPOSED OF PORTLAND CEMENT, FINE AND COARSE AGGRAGATES, AND AN AIR ENTRAINED ADMIXTURE THAT CONFORMS TO AASHTO M154.

- CONCRETE SHALL HAVE 6±2 PERCENT AIR
- PORTLAND CEMENT SHALL CONFORM TO ASTM C150 TYPE I, TYPE II, OR TYPE III CEMENT
- COARSE AGGREGATE SHALL MEET SECTION 805.04 OF THE KENTUCKY STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND HAVE A MAXIMUM SIZE OF 1 INCH
- WATER REDUCING ADMIXTURES FOR THE PURPOSE OF INCREASING THE WORKABILITY OF THE CONCRETE, MAY BE SUBMITTED BY THE MANUFACTURE TO THE ENGINEER FOR APPROVAL.
- CALCIUM CHLORIDE OR ADMIXTURES CONTAINING IT ARE NOT ALLOWED TO BE ADDED TO THE CONCRETE
- CEMENT CONTENT MUST BE IN EXCESS OF 564 POUNDS PER CUBIC YARD
- MINIMUM COMPRESSIVE STRENGTH OF CONCRETE SHALL BE SPECIFIED ON SHOP DRAWINGS OF STRUCTURE

4. MATERIALS - STEEL REINFORCEMENT AND HARDWARE

ALL REINFORCEMENT USED IN THE PRECAST ELEMENTS SHALL CONFORM TO ASTM SPECIFICATION A 185 OR A 497. DEFORMED BILLET STEEL SHALL CONFORM TO ASTM A 615, GRADE 60. STEEL REINFORCING SHALL HAVE A MINIMUM YIELD STRENGTH OF 60,000 PSI. STEEL REINFORCING SHALL BE PLACED ACCORDING TO THE DETAILS AND PLANS SHOWN ON THE SHOP DRAWINGS. WELDED WIRE FABRIC USED FOR THE CIRCUMFERENTIAL STE EL SHALL HAVE A MINIMUM SPACING OF 2 INCHES AND MAXIMUM OF 4 INCHES. STEEL HARDWARE AND INSERTS USED BY MANUFACTURER SHALL BE SUBMITTED TO THE ENG INEER FOR APPROVAL.

5. FABRICATION OF PRECAST ELEMENTS

FORMS SHALL BE SUFFICIENTLY RIGID TO MAINTAIN STRUCTURE SHAPE.
REINFORCEMENT SHALL BE BENT TO APPROXIMATELY MATCH THE OUTSIDE CORNER OF THE STRUCTURE. REINFORCEMENT SHALL BE WELDED WIRE FABRIC AND SUPPLEMENTED WITH A LAYER DEFORMED BILLET STEEL BARS WHEN NECESSARY. LONGITUDINAL REINFORCING MUST BE WITHIN 3 INCHES FROM ENDS OF PRECAST ELEMENTS.

- STORAGE OF UNITS SHOULD BE IN A MANNER THAT PREVENTS ANY DAMAGE OR CRACKING AND IN A FASHION APPROVED BY THE ENGINEER
- HARDWARE OR HOLES SHALL BE CAST INTO PRECAST ELEMENTS TO FACILITATE HANDLING
- CONCRETE SHALL MEET MINIMUM DESIGN STRENGTH BEFORE 28 DAYS AFTER IT WAS CAST AND BEFORE THE ELEMENT IS SHIPPED
- TENSION SPLICES IN CIRCUMFERENTIAL REINFORCING SHALL BE MADE BY LAPPING AND MUST CONFORM TO AASHTO 5.11.6.2 FOR SMOOTH WELDED WIRE FABRIC. THE DEFORMED WELDED WIRE REINFORCEMENT SHALL CONFORM TO AASHTO 5.11.6.1. LAPS MAY BE TACK WELDED FOR CONSTRUCTION PURPOSES ONLY. FOR SPLICES OTHER THAN TENSION SPLICES, THE OVERLAP SHALL BE AT LEAST 12 INCHES FOR WELDED WIRE FABRIC OR 24" DEFORMED BARS. OVERLAP OF WELDED WIRE FABRIC SHALL BE MEASURED FROM OUTER MOST CROSS WIRES OF EACH FABRIC SHEET. OVERLAP FOR DEFORMED BARS SHALL MEET AASHTO 5.11.5.

6. QUALITY ASSURANCE

THE PRECAST PLANT SHALL BE CERTIFIED BY THE NATIONAL PRECAST CONCRETE ASSOCIATION'S PLANT CERTIFICATION PROGRAM OR PRECAST/PRESTRESSED CONCRETE INSTITUTE PLANT CERTIFICATION DURING PRODUCTION OF ALL PRECAST ELEMENT S AND CONFORM TO SECTION 605 OF THE KENTUCKY STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

THE PRECAST PLANT RETAIN AN INDEPENDENT TESTING AGENCY TO PERFORM TESTS FOR AIR ENTRAINMENT AND COMPRESSIVE STRENGTH. THESE TESTS ARE TO COMPLY WITH ASTM C231 OR C173 FOR AIR ENTRAINMENT AND ASTM C39. THESE TESTS ARE TO BE DONE AT INTERVALS STATED IN SECTION 7 OF THIS SPECIFICATION. THE AGENCY MUST PROVIDE THE PRECAST PLANT CERTIFICATION, BY A LICENSED ENGINEER, STATING THAT THE PLANT IS IN COMPLIANCE WITH THESE TEST.

THE PRECAST PLANT SHALL PROVIDE PROOF OF COMPLIANCE OF THIS SECTION UPON REQUEST.

7. TESTING AND INSPECTION

COMPRESSION TESTING SHALL BE DONE ON CONCRETE CYLINDERS. A MINIMUM OF 3 CYLINDERS ARE TO BE MADE FOR EACH GROUP OF CONCRETE ELEMENTS CAST FROM THE SAME CONCRETE MIX ON THE SAME DAY. CYLINDERS ARE TO BE TESTED IN ACCORDANCE WITH ASTM C39.

IF THE AVERAGE COMPRESSIVE STRENGTH OF ALL CYLINDERS TAKEN FROM GIVEN CONCRETE MIX ON THE SAME DAY IS EQUAL TO OR GREATER THAN THE DESIGN COMPRESSIVE STRENGTH, THE CYLINDERS ARE ACCEPTED. IF THE CYLINDERS DO NOT MEET THIS CRITERIA, A MINIMUM OF THREE CORES SHALL BE OBTAINED FROM THE PRECAST ELEMENTS MADE WITH THE SAME CONCRETE MIX FROM THE FAILED CYLINDERS.

CORES SHALL BE BE OBTAINED AND TESTED IN ACCORDANCE WITH ASTM C42. IF THE AVERAGE COMPRESSIVE STRENGTH IS EQUAL TO OR GREATER THAN THE DESIGN COMPRESSIVE STRENGTH, THE CORES ARE ACCEPTABLE.

WHEN THE COMPRESSIVE STRENGTH OF ANY CORE IS LESS THAN THE DESIGN COMPRESSIVE STRENGTH, THE PRECAST ELEMENT THE CORE WAS TAKEN FROM SHALL BE REJECTED. THE REMAINING PRECAST ELEMENTS MADE FROM THE SAME CONCRETE MIX ON THE SAME DAY ARE TO BE REJECTED, UNLESS AT THE OPTION OF THE OWNER, EACH ELEMENT CAN BE CORED AND ACCEPTED INDIVIDUALLY.
CORE HOLES SHALL BE PLUGGED AND SEALED BY THE PRECAST PLANT IN A MANNER TO MEET THIS SPECIFICATION.
THE OWNER OR OWNER'S AGENT MAY INSPECT THE MATERIAL, MANUFACTURE AND FINISHED PRECAST ELEMENTS AT THEIR DISCRETION.

8. PERMISSIBLE VARIATIONS

BRIDGE UNITS SHALL BE MANUFACTURED SO THAT ARCH AND LEG DIMENSIONS ARE NOT MORE THAN $\frac{1}{4}$" DIFFERENT THAN WHAT IS SHOWN ON THE SHOP DRAWINGS. THE LAY LENGTH OF THE BRIDGE UNITS SHALL NOT VARY MORE THAN $\frac{1}{2}$" OVER THE LENGTH OF THE STRUCTURE.

WINGWALL AND HEADWALL ARE TO BE MANUFACTURED SO THAT THE LENGTH, HEIGHT AND THICKNESS DOES NOT VARY MORE THAN 1/2" FROM WHAT IS SHOWN ON THE SHOP DRAWINGS.

REINFORCEMENT PLACING SHALL NOT VARY MORE THAN $\frac{1}{2}$" FROM THAT WHICH IS SHOWN ON THE SHOP DRAWINGS. REINFORCING CONCRETE COVER SHALL NEVER BE LESS THAN 1-1/2"

9. JOINTS

BRIDGE UNITS UTILIZE BUTT ENDS AND ARE TO BE MANUFACTURED SO THAT WHEN PLACED NEXT TO EACH OTHER, THEY PROVIDE A CLEAN, CONTINUOUS LINE OF SECTIONS THAT ARE FREE OF ANY IRREGULARITIES. THE MAXIMUM PERMISSIBLE JOINT SHALL BE A MAXIMUM OF $\frac{3}{4}$"

10. WORKMANSHIP AND FINISH

PRECAST ELEMENTS ARE TO HAVE A SMOOTH STEEL FORM OR TROWELED SURFACE. THE ENDS OF BRIDGE UNITS SHALL BE NORMAL TO THE WALLS AND CENTERLINE OF THE ARCH. THE PRECAST ELEMENTS SHALL BE FREE OF ANY SUBSTANTIAL FRACTURE OR BLEMISH.

REPAIRS TO A PRECAST ELEMENT BECAUSE OF FRACTURES OR BLEMISHES CAUSED BY HANDLING OR INSTALLING, MAY BE APPROVED, IN THE OPINION OF THE OWNER, IF THE REPAIRS ARE PROPERLY FINISHED AND CURED TO MEET THIS SPECIFICATION.

11. REJECTION

PRECAST ELEMENTS MAY BE REJECTED FOR EXCESSIVE HONEYCOMBING, DAMAGED ENDS OR FRACTURES AND CRACKS PASSING THROUGH THE WALL

12. MARKING

EACH PRECAST ELEMENT IS TO BE MARKED BY PERMANENT PAINT. THE MINIMUM MARKING SHALL INCLUDE THE DATE OF MANUFACTURE, TRADEMARK OR NAME OF PRECAST PLANT, AND PIECE MARK FROM SHOP DRAWINGS. BRIDGE UNITS SHALL INCLUDE SPAN AND RISE IN THE MARK.

13. CONSTRUCTION

THE BRIDGE UNITS AND WINGWALLS SHALL BE INSTALLED ON CAST IN PLACE FOUNDATIONS PER THE PLANS. THE CONTRACTOR SHALL VERIFY THAT THE FOUNDATION SUBGRADE IS IN COMPLIANCE WITH THE GEOTECHNICAL REPORT FOR THE PROJECT.

THE FOOTINGS SHALL HAVE A SMOOTH FLOAT FINISH WITH A MINIMUM COMPRESSIVE STRENGTH AS SPECIFIED IN THE DESIGN NOTESI. THE SURFACE OF THE FOUNDATION SHALL NOT VERY BY MORE THAN $\frac{1}{4}$" WHEN MEASURED WITH A 10 FOOT STRAIGHT EDGE. THE FOOTINGS SHALL HAVE REACHED A MINIMUM OF 2000 PSI BEFORE INSTALLATION OF ANY PRECAST ELEMENTS. FOUNDATION DIMENSION SHALL MATCH THOSE THAT ARE SHOWN ON THE PLANS.

PRECAST ELEMENTS SHALL BE INSTALLED AS SHOWN ON THE PLANS AND SPECIAL CARE SHALL BE TAKEN TO VERIFY THAT ELEMENTS ARE PLACED TO FOLLOW THE DESIGNATED CENTERLINE OF THE STRUCTURE. BRIDGE STRUCTURES AND WINGWALLS ARE TO BE PLACED ON MASONITE SHIMS TO ALLOW A MINIMUM OF $\frac{1}{2}$" CLEARANCE BETWEEN BOTTOM OF PRECAST ELEMENT AND TOP OF FOOTING. GAP TO BE FILLED WITH NON-SHRINK GROUT FROM THE KYTC DIVISION OF MATERIALS "LIST OF APPROVED MATERIALS".

BUTT JOINTS BETWEEN BRIDGE UNITS SHALL BE COVERED WITH A $\frac{7}{8}$" X 1$\frac{3}{8}$" BUTYL ROPE AND A 9" WIDE STRIP OF JOINT WRAP. A PRIMER COMPATIBLE WITH THE JOINT WRAP TO BE APPLIED ON EACH SIDE OF THE BUTT JOINT ON A CLEAN SURFACE. JOINT PROTECTION SHALL EXTEND FROM BOTTOM OF ONE LEG, UP OVER ARCH AND DOWN OPPOSITE LEG. ANY LAPS SHALL HAVE 6" OF OVERLAP AND HAVE OVERLAP RUNNING DOWN HILL.

LIFT HOLES ARE TO BE FILLED, PRIMED AND COVERED WITH JOINT WRAP. EDGES ALONG HEADWALL COLLAR AND TOP OF BRIDGE UNIT TO BE COVERED WITH JOINT WRAP AND PRIMER. HEADWALLS THAT ARE CAST INTEGRAL WITH A BRIDGE UNIT REQUIRES NO TYPE OF JOINT PROTECTION.

JOINTS BETWEEN WINGWALL SECTIONS AND JOINTS BETWEEN A WINGWALL AND BRIDGE UNIT SHALL BE SEALED WITH A 2' WIDE STRIP OF FILTER FABRIC.

BACKFILL IS DEFINED AS ALL REPLACED EXCAVATION AND NEW EMBANKMENT MATERIAL THAT IS ADJACENT TO THE THREE SIDED STRUCTURE, WINGWALLS AND HEADWALLS. BACKFILL MATERIAL WITHIN ZONE A, AS SHOWN ON FIGURE 1 OF THIS PAGE, MUST MEET THE MATERIAL SPECIFICATIONS AS SET FORTH IN TABLE 1 ON THIS PAGE.

ALL BACKFILL IN ZONE A IS TO BE COMPACTED TO A MINIMUM DENSITY OF 95% STANDARD PROCTOR PER AASHTO T-99.

SPECIAL CARE IS TO BE TAKEN DURING BACKFILLING TO PROTECT THE PLACEMENT OF JOINT WRAP OR ANY WATERPROOFING MATERIAL.

MECHANICAL TAMPERS OR APPROVED COMPACTING EQUIPMENT SHALL BE USED ON ALL BACKFILL MATERIAL THAT IS DIRECTLY ADJACENT TO THE STRUCTURAL ELEMENTS AND OVER THE TOP OF THE STRUCTURE UNTIL THERE IS AT LEAST 1' OF COVER OVER THE TOP. BACKFILL MATERIAL IN ZONE A SHALL BE PLACED IN 8" LIFTS (MAXIMUM) BEFORE BEING COMPACTED. AT NO TIME SHALL HEAVY CONSTRUCTION OR BACKFILLING EQUIPMENT IN EXCESS OF 12 TON BE PERMITTED OVER THE STRUCTURE OR WITHIN 3' OF ANY STRUCTURAL ELEMENT WITHOUT AT LEAST 2' OF COVER OVER THE STRUCTURE UNLESS THE STRUCTURE IS DESIGNED FOR LESS COVER.

DURING BACKFILLING, AT NO TIME SHALL THERE BE MORE THAN 24" DIFFERENCE BETWEEN BACKFILL HEIGHT ON EACH SIDE OF THE CULVERT.

SYSTEM: ECOSPAN ARCH SYSTEMS

	DATE	DESCRIPTION	ENG
7			
6			
5			
4			
3			
2			
1	3/29/12	REVISED 54' AND 60' ARCH BOX GEOMETRY	TEN

LOCALE: STATE:

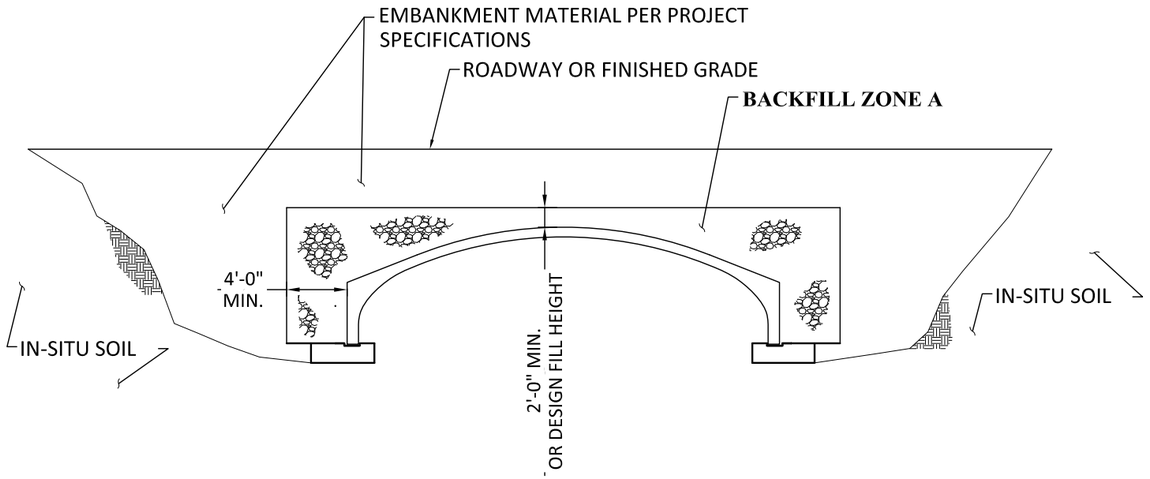
KENTUCKY TRANSPORTATION CABINET
STANDARD BRIDGE SYSTEM DETAILS
page 42

PROVIDED BY: API AMERICAN PREFABRICATED INFRASTRUCTURE ™
AMERICAN PREFABRICATED INFRASTRUCTURE, LLC
937.848.1001

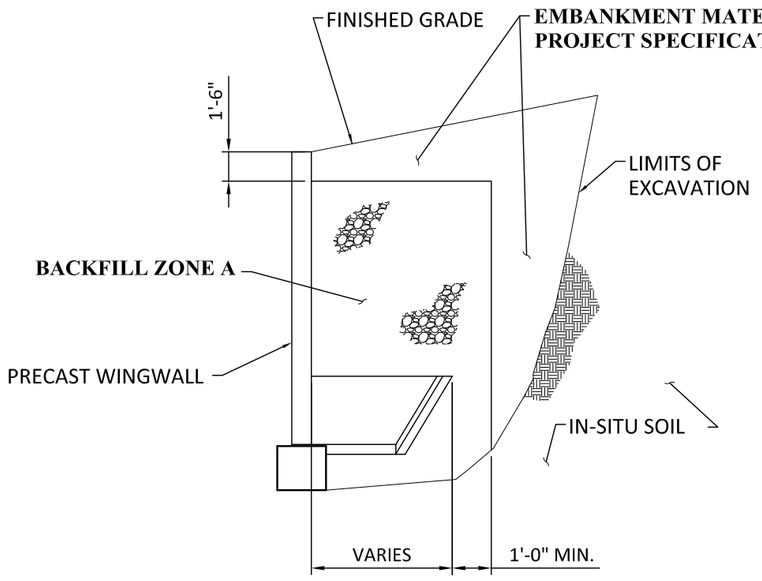
DESIGNED BY: STRUCTURESIGHT
9840 HAINES ROAD
WAYNESVILLE, OH 45068
937.401.2461
WWW.STRUCTURESIGHT.COM

PROJECT NUMBER:
DATE: 3/3/11
DESIGNED BY: JJV
DRAWN BY: JJV
CHECKED BY: JJV

5/6



BRIDGE BACKFILL LIMITS



WINGWALL BACKFILL LIMITS

BACKFILL DESCRIPTION

GROUP CLASSIFICATION	A-1a	A-1b	A-2-4	A-2-5	A3	A4
PERCENT PASSING #10	50 MAX.					
PERCENT PASSING #40	30 MAX.	50 MAX.			51 MAX.	
PRECENT PASSING #200	15 MAX.	25 MAX.	35 MAX.	35 MAX.	10 MAX.	36 MAX.
CHARACTERISTICS OF FRACTON PASSING #40, LIQUID LIMIT			40 MAX.	41 MAX.		40 MAX.
CHARACTERISTIC OF FRACTION PASSING #40, PLASTICITY INDEX	6 MAX.	9 MAX.	10 MAX.	10 MAX.		10 MAX.
DESCRIPTION OF MATERIAL	MOSTLY GRAVEL WITH SOME SANDS AND FINES	GRAVELLY SAND OR GRADED SAND	SILTY OR CLAYEY GRAVEL AND SAND	SILTY OR CLAYEY GRAVEL AND SAND	FINE SAND	LOW COMP. SILTS

ACCEPTABLE BACKFILL MATERIAL

SPAN	FILL HEIGHT	MATERIAL IN ZONE A
< 24'-0"	< 12'-0"	A1, A2, A3, A4
< 24'-0"	≥ 12'-0"	A1, A3
≥ 24'-0"	ALL	A1, A3

MATERIALS

ALL CONSTRUCTION MATERIALS SHALL BE IN ACCORDANCE WITH KYTC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, KYTC LIST OF APPROVED MATERIALS, AND ALL APPLICABLE ASTM AND AASHTO STANDARDS.

PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED BY A KYTC APPROVED FABRICATOR, IN ACCORDANCE WITH THE PLANS AND IN STRICT COMPLIANCE WITH SECTION 605 OF THE KYTC DEPARTMENT OF HIGHWAYS, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

ALL MATERIALS SHALL BE PROVIDED IN ACCORDANCE WITH SECTION 106.4 OF THE KYTC STANDARD SPECIFICATIONS BUY AMERICA REQUIREMENT.

CONCRETE SHALL BE IN ACCORDANCE WITH SECTION 601 OF THE KYTC SPECIFICATIONS. MINIMUM CONCRETE COMPRESSIVE STRENGTH SHALL BE 5,000 PSI FOR ARCH UNITS, 4,000 PSI FOR WINGWALLS AND HEADWALLS, AND 3,500 PSI FOR FOUNDATIONS, UNLESS HIGHER STRENGTHS ARE SPECIFIED ON THE SHOP DRAWINGS.

REINFORCING STEEL FOR PRECAST UNITS, HEADWALLS AND WINGWALLS SHALL BE EITHER WELDED WIRE FABRIC, DEFORMED WELDED WIRE FABRIC OR DEFORMED STEEL BARS IN ACCORDANCE WITH KYTC SPECIFICATIONS.

CAST-IN-PLACE STRIP FOUNDATIONS SHALL BEAR ON NON-ERODIBLE ROCK FOUNDATION MATERIAL UNLESS OTHERWISE APPROVED BY THE KYTC DEPARTMENT OF HIGHWAYS.

4"Ø WEEP HOLES SHALL BE PROVIDED IN ARCH UNITS AND PRECAST WINGWALLS IN ACCORDANCE WITH SECTION 611 OF KYTC STANDARD SPECIFICATIONS.

SYSTEM: ECOSPAN ARCH SYSTEMS

	DATE	DESCRIPTION	ENG
7			
6			
5			
4			
3			
2			
1	3/29/12	REVISED 54' AND 60' ARCH BOX GEOMETRY	TEN

KENTUCKY TRANSPORTATION CABINET
STANDARD BRIDGE SYSTEM DETAILS
page 43

LOCALE: STATE:

PROVIDED BY: API AMERICAN PREFABRICATED INFRASTRUCTURE ™
AMERICAN PREFABRICATED INFRASTRUCTURE, LLC
937.848.1001

DESIGNED BY: STRUCTURESIGHT
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PROJECT NUMBER:
DATE: 3/3/11
DESIGNED BY: JJV
DRAWN BY: JJV
CHECKED BY: JJV

6/6

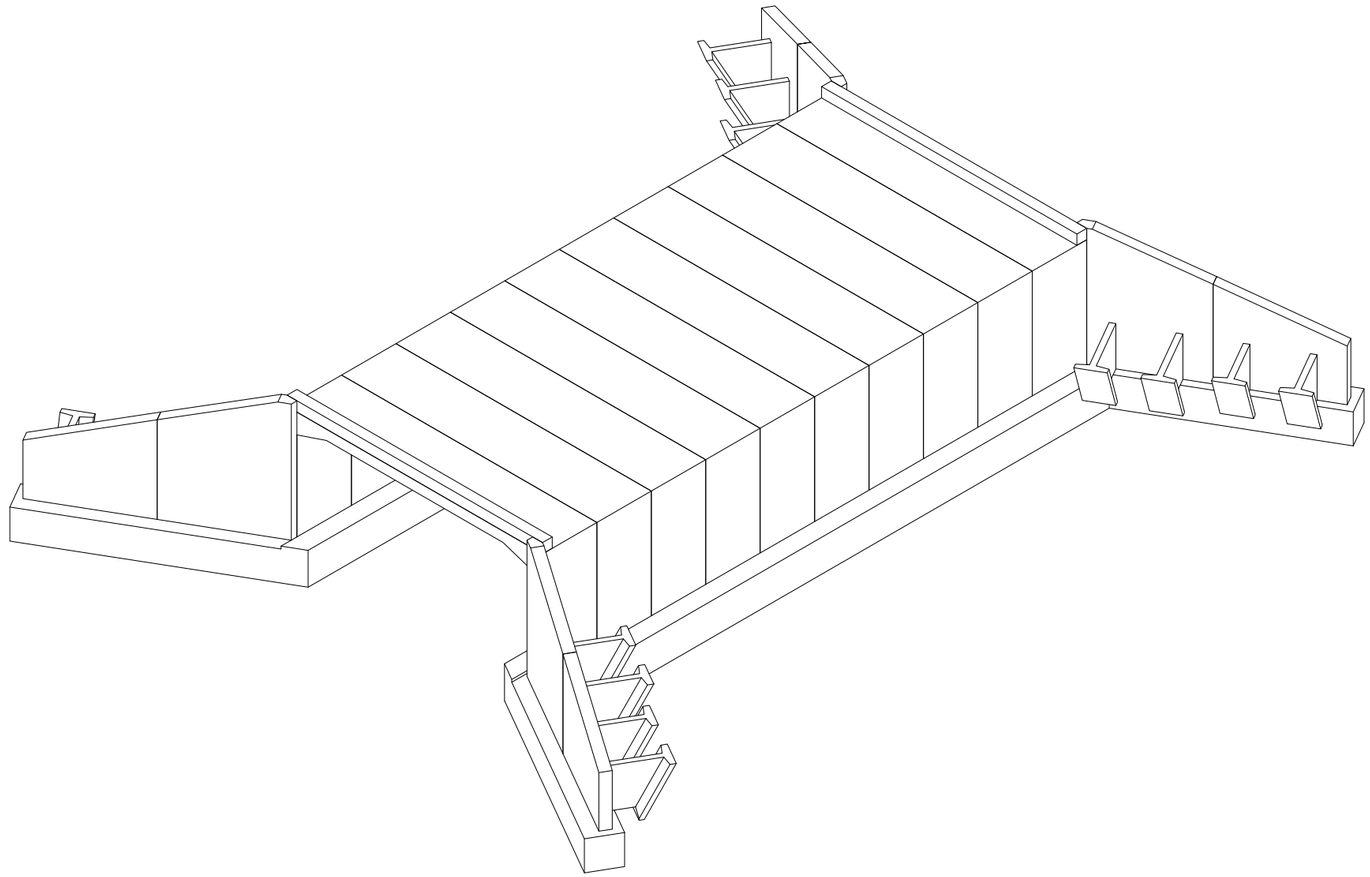
HY-SPAN BRIDGE SYSTEM DRAWINGS AND DETAILS

INDEX	
1	TITLE SHEET
2	BRIDGE DETAILS
3	FOOTING AND JOINT DETAILS
4	HEADWALL AND WINGWALL DETAILS
5	GENERAL NOTES AND SPECIFICATIONS

/ HY-SPAN®

The Instant Bridge™

GUIDELINES FOR HY-SPAN BRIDGE SYSTEMS
PREPARED FOR
KENTUCKY TRANSPORTATION CABINET



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Sym.	Revisions	Date

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Drawn: AJE/MAM
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Date: 2/24/12

HY-SPAN BRIDGE SYSTEM

HY-SPAN SYSTEMS, INC./ A SUBSIDIARY OF INDEPENDENT CONCRETE PIPE CO.

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TOLEDO OH	(419)841-3361

Project No:

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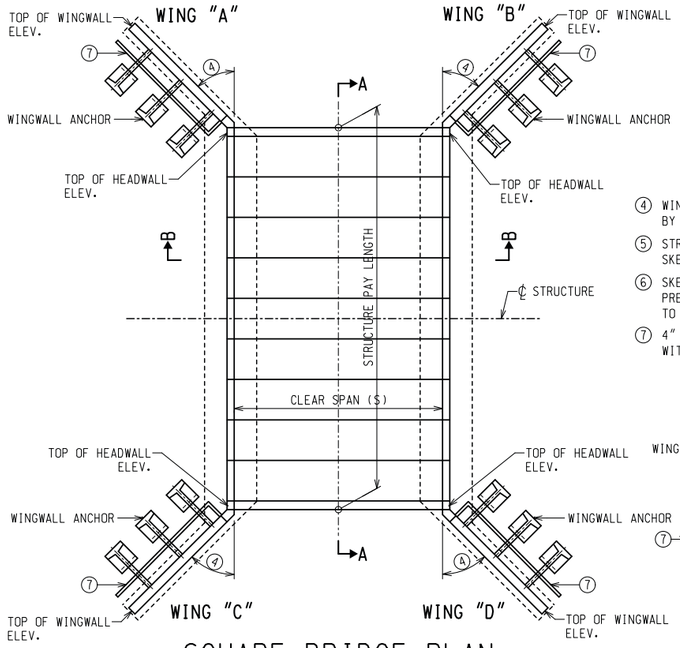
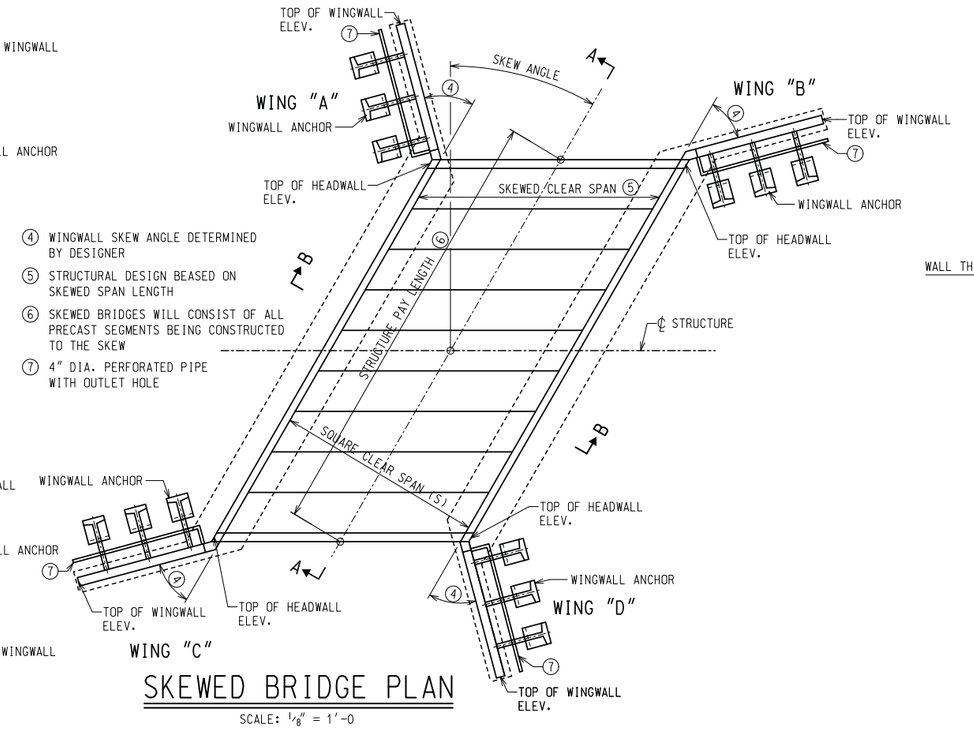
1 of 5



SQUARE BRIDGE PLAN

SCALE: 1/8" = 1'-0



(4) WINGWALL SKEW ANGLE DETERMINED BY DESIGNER

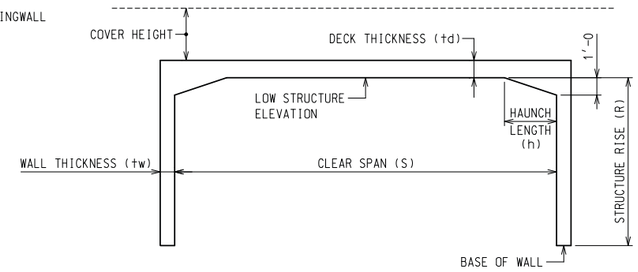
(5) STRUCTURAL DESIGN BEASED ON SKEWED SPAN LENGTH

(6) SKEWED BRIDGES WILL CONSIST OF ALL PRECAST SEGMENTS BEING CONSTRUCTED TO THE SKEW

(7) 4" DIA. PERFORATED PIPE WITH OUTLET HOLE

SKEWED BRIDGE PLAN

SCALE: 1/8" = 1'-0

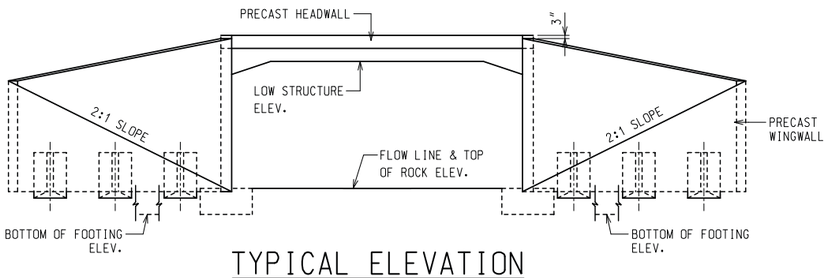


S ① (FT²)	R ① (FT)	td (IN)	tw (IN)	h (FT)	MAXIMUM ② COVER HEIGHT	WATERWAY ③ OPENING
14	4	12	10	3	15'-0	53.0
14	6	12	10	3	15'-0	81.0
14	8	12	10	3	15'-0	109.0
14	10	12	10	3	15'-0	137.0
16	4	12	10	3	15'-0	61.0
16	6	12	10	3	15'-0	93.0
16	8	12	10	3	15'-0	125.0
16	10	12	10	3	15'-0	157.0
18	4	12	10	3	15'-0	69.0
18	6	12	10	3	15'-0	105.0
18	8	12	10	3	15'-0	141.0
18	10	12	10	3	15'-0	177.0
20	4	12	10	3	15'-0	77.0
20	6	12	10	3	15'-0	117.0
20	8	12	10	3	15'-0	157.0
20	10	12	10	3	15'-0	197.0
22	4	12	11	3	8'-0	85.0
22	6	12	10	3	8'-0	129.0
22	8	12	10	3	8'-0	173.0
22	10	12	10	3	8'-0	217.0
24	4	12	12	6.67	8'-0	89.3
24	6	12	12	6.67	8'-0	137.3
24	8	12	12	6.67	8'-0	185.3
24	10	12	12	6.67	8'-0	233.3
26	4	12	14	6.67	5'-0	97.3
26	6	12	12	6.67	5'-0	149.3
26	8	12	12	6.67	5'-0	201.3
26	10	12	12	6.67	5'-0	253.3
28	4	12	15	6.67	5'-0	105.3
28	6	12	13	6.67	5'-0	161.3
28	8	12	12	6.67	5'-0	217.3
28	10	12	12	6.67	5'-0	273.3
30	4	13	17	6.67	4'-0	113.3
30	6	13	15	6.67	4'-0	173.3
30	8	13	14	6.67	4'-0	233.3
30	10	12	14	6.67	4'-0	293.3
32	4	13	19	6.67	4'-0	122.3
32	6	13	17	6.67	4'-0	185.3
32	8	13	14	6.67	4'-0	249.3
32	10	12	14	6.67	4'-0	313.3
34	4	13	20	14	4'-0	122.0
34	6	13	18	14	4'-0	190.0
34	8	13	15	14	4'-0	258.0
34	10	13	15	14	4'-0	326.0
36	6	14	19	14	4'-0	202.0
36	8	14	16	14	4'-0	274.0
36	10	13	16	14	4'-0	346.0
36	12	13	16	14	4'-0	418.0
38	8	14	18	14	3'-0	290.0
38	10	14	18	14	3'-0	366.0
40	8	15	20	14	3'-0	306.0
40	10	15	20	14	3'-0	386.0

① SPAN AND RISE COMINATIONS SHOWN ARE NOMINAL. HY-SPAN STRUCTURES CAN BE FURNISHED IN VIRTUALLY ANY COMBINATION OF SPAN AND RISE. EITHER THE SPAN AND/OR RISE MAY BE FRACTIONAL TO MEET SPECIFIC SITE REQUIREMENTS.

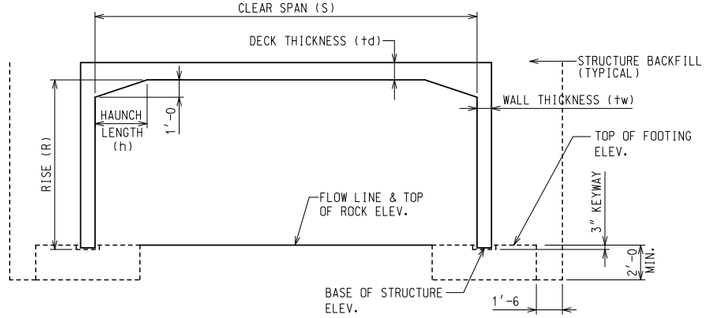
② MAXIMUM COVER HEIGHTS ARE FOR THE MINIMUM MEMBER SIZES REQUIRED FOR EACH SPAN RANGE. STRUCTURES EXCEEDING THIS FILL CAN BE FURNISHED BY INCREASING MEMBER SIZES AS DETERMINED DURING THE DESIGN PROCESS.

③ WATERWAY AREA SHOWN IS FROM LOW STRUCTURE ELEVATION TO BASE OF WALL WITH HAUNCH AREAS DEDUCTED.



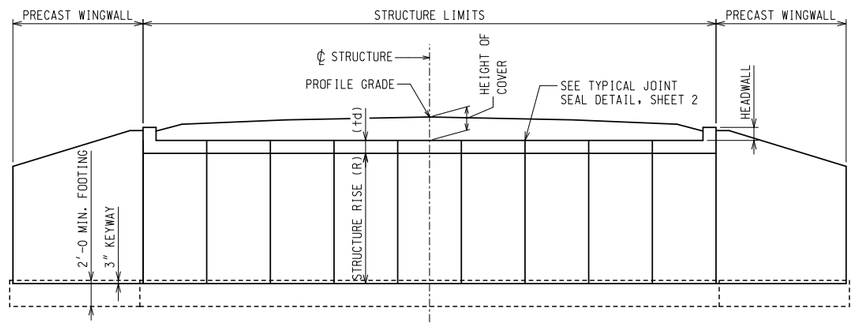
TYPICAL ELEVATION

SCALE: 3/16" = 1'-0



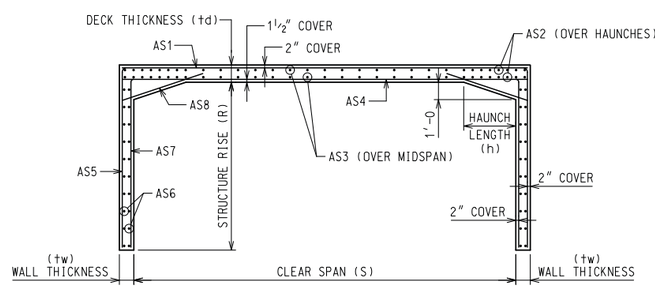
SECTION B-B

SCALE: 1/4" = 1'-0



SECTION A-A

SCALE: 1/4" = 1'-0



TYPICAL STRUCTURE REINFORCING

SCALE: 1/4" = 1'-0

NOTE: REINFORCING SIZE AND SPACING DETERMINED DURING PREPARATION OF STRUCTURAL DESIGN AND SHOP DRAWINGS.

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HY-SPAN BRIDGE SYSTEM

BRIDGE DETAILS

HY-SPAN SYSTEMS, INC./ A SUBSIDIARY OF INDEPENDENT CONCRETE PIPE CO.

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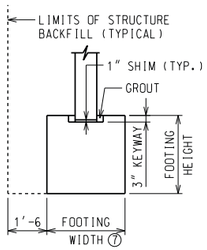
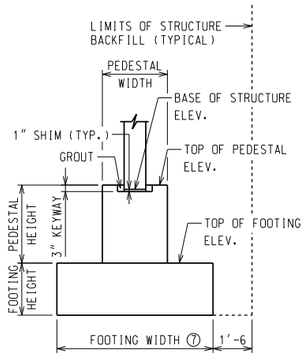


TYPICAL CULVERT FOOTING

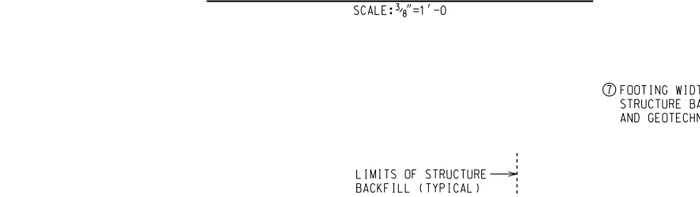
SCALE: $\frac{3}{8}$"=1'-0

⑦ FOOTING WIDTH DETERMINED FOR EACH STRUCTURE BASED ON APPLIED LOADS AND GEOTECHNICAL PARAMETERS.



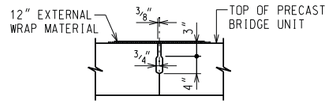
TYPICAL CULVERT FOOTING WITH PEDESTALS

SCALE: $\frac{3}{8}$"=1'-0



TYPICAL BASE SLAB DETAIL

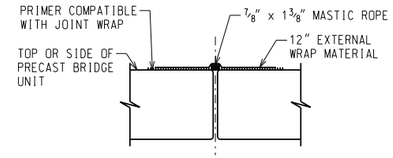
SCALE: $\frac{3}{8}$"=1'-0



TYPICAL KEYWAY DETAIL

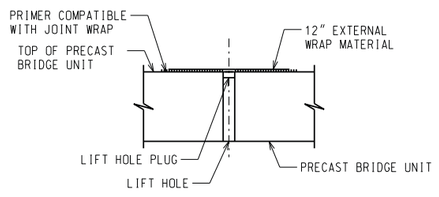
(DECKS WITH LESS THAN 3' OF COVER)
SCALE: $\frac{3}{4}$"=1'-0

NOTE: AFTER ERECTION THE JOINT SHALL BE FILLED WITH NON-SHRINK GROUT.

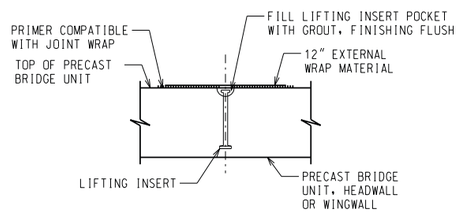


TYPICAL JOINT SEAL DETAIL

(WALLS & DECKS WITH 3'-0 OR GREATER COVER)
SCALE: 1" = 1'-0



LIFTING HOLES



LIFTING INSERTS

TYPICAL LIFTING INSERTS

SCALE: 1" = 1'-0

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HY-SPAN BRIDGE SYSTEM

FOOTING AND JOINT DETAILS

HY-SPAN SYSTEMS, INC./ A SUBSIDIARY OF INDEPENDENT CONCRETE PIPE CO.

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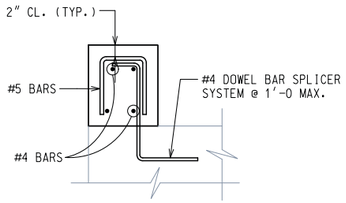
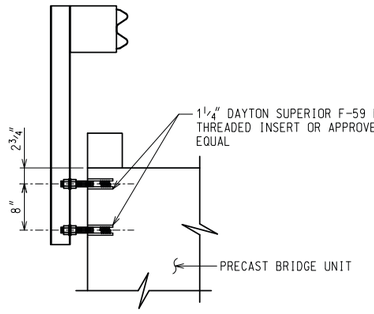


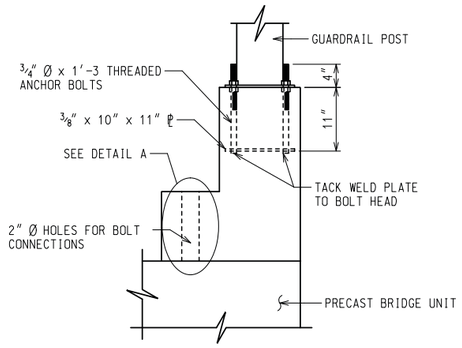
TYPICAL PRECAST HEADWALL

(CAST ON AT PLANT)
SCALE: 1" = 1'-0



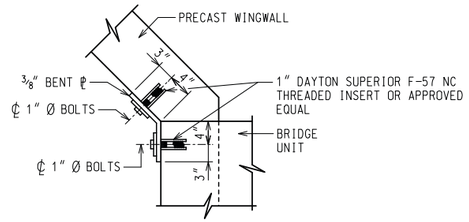
SIDE MOUNTED GUARDRAIL

SCALE: 1"=1'-0



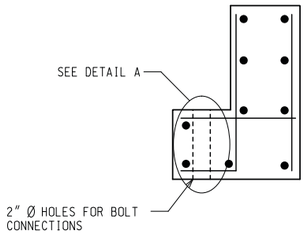
TOP MOUNTED GUARDRAIL

SCALE: 1"=1'-0



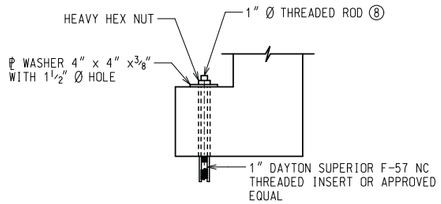
TYPICAL WINGWALL CONNECTION DETAIL

SCALE: 1"=1'-0



TYPICAL PRECAST HEADWALL

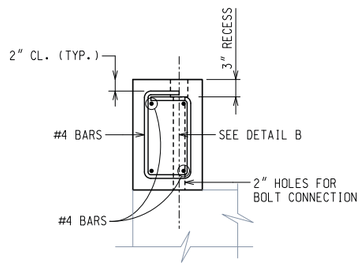
(FIELD BOLTED AT SITE: HEIGHT GREATER THAN 2')
SCALE: 1"=1'-0



DETAIL "A"

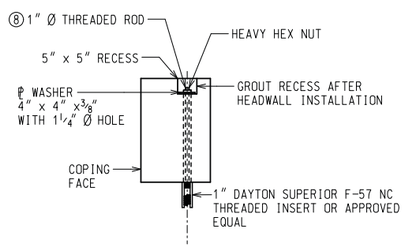
SCALE: 1"=1'-0

⑧ REQUIRED SPACING OF INSERTS AND THREADED RODS TO BE DETERMINED AS PER STRUCTURAL DESIGN AND SHOP DRAWING PREPARATION.



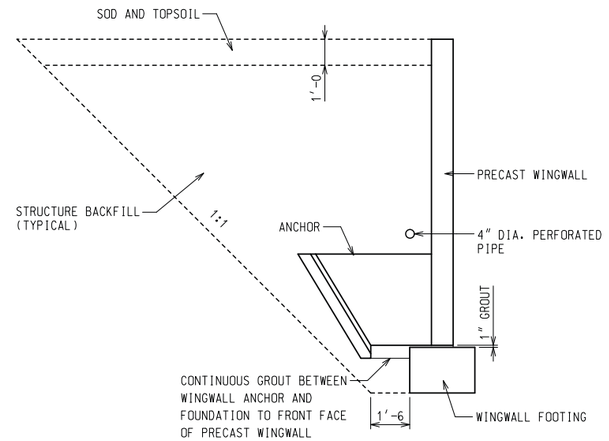
TYPICAL PRECAST HEADWALL

(FIELD BOLTED ON SITE: HEIGHT LESS THAN 2')
SCALE: 1"=1'-0



DETAIL "B"

SCALE: 1"=1'-0



TYPICAL PRECAST WINGWALL

SCALE: 3/8"=1'-0

HY-SPAN / The Instant Bridge

Sym.	Revisions	Date

Designed: SJC
Drawn: AJE/MAM
Checked: SJC
Scale: As Noted
Date: 2/24/12

HY-SPAN BRIDGE SYSTEM

HEADWALL AND WINGWALL DETAILS

HY-SPAN SYSTEMS, INC./ A SUBSIDIARY OF INDEPENDENT CONCRETE PIPE CO.

SALES OFFICES	TELEPHONE
LOUISVILLE, KY	(502)448-2920
INDIANAPOLIS, IN	(317)262-4920
MISHAWAKA, IN	(219)259-5401
ST. LOUIS, MO	(314)842-2900
TOLEDO OH	(419)841-3361

Project No:

Sheet No: 4 of 5

GENERAL NOTES AND SPECIFICATIONS FOR HY-SPAN BRIDGE SYSTEMS

DESCRIPTION

(1) This work shall consist of constructing a precast reinforced concrete three-sided flat-topped structure with headwalls and wingwalls in accordance with the design plans, these standard details, and the following specifications.

MATERIALS

(2) All precast concrete work will be performed by Independent Concrete Pipe Corporation /Hy-Span Bridge Systems, a KYTC approved supplier of precast concrete components. All components will be in strict compliance with section 615 of the KYTC Standard Specifications for Road and Bridge Construction.

(3) All materials shall be in conformance with KYTC Standard Specifications for Road and Bridge Construction, the KYTC List of Approved Materials, section 106.04 of the KYTC Standard Specifications regarding the Buy American Requirement, and all applicable ASTM and AASHTO standards.

(4) Reinforcing steel in structure sections shall be welded wire fabric, welded deformed steel wire fabric, or deformed billet steel bars in accordance with KYTC Standard Specifications, Section 811. Reinforcing steel in the wingwalls, pedestals, base slabs, headwalls, and footings shall be deformed billet steel bars in accordance with KYTC Standard Specifications, Section 811. Reinforcing steel in headwalls and structure sections with less than two feet of cover shall be epoxy coated.

(5) Concrete shall be in accordance with Section 601 of the KYTC Standard Specifications utilizing the following design strengths. The minimum 28 day concrete design strength shall be f'c = 5,000 psi for structure sections, f'c = 4,000 for headwalls and wingwalls and f'c = 3,500 psi for footings. Structure sections for spans greater than 30' shall utilize f'c from 5,000 psi up to a maximum of 6,000 psi as determined during design of the structure.

(6) Steel used in bolted connections of wingwalls to structure sections shall be in accordance with ASTM A 709 grade 36 (ASTM A 709M grade 250) and galvanized after fabrication in accordance with ASTM A 153 (ASTM A 153M), Class A or B. Bolts shall be in accordance with ASTM A 307 and galvanized in accordance with ASTM A 153 (ASTM A 153M)

DESIGN

(7) Hy-Span Systems on behalf of the Contractor shall submit, for approval, three copies of design computations and shop drawings. The index sheet of the design calculations and each sheet of the shop drawings shall be signed by and bearing the seal of a Kentucky licensed professional engineer. The shop drawings shall include all details, dimensions, and quantities necessary to construct the structure, wingwalls, and headwalls if applicable and shall include, but not be limited to, the following information.

- (a) Structure span and rise;
- (b) Structure section details showing all concrete dimensions and reinforcing steel requirements;
- (c) Design computations and details for pedestals, when required;
- (d) Footing details showing all concrete dimensions, elevations, and reinforcing steel with bar size, bar bending diagrams, length, and spacing indicated. Footing plan and section views shall be provided. The actual soil bearing pressure shall be noted on the footing detail sheets.
- (e) Wingwall design computations and details showing all concrete dimensions, reinforcing steel, bar bending diagrams, and anchorage details. Wingwall plan, elevation, and section views shall be provided.
- (f) Headwall details, showing all concrete dimensions, reinforcing steel, bar bending diagrams, and anchorage details. Headwall elevation and section views shall be provided.
- (g) Structure backfill type and limits for the structure and wingwalls.

(8) Structure section or wingwall fabrication shall not begin until written approval of the shop drawings and design computations have been received from the Engineer.

(9) The structure sections shall be designed for:

- (a) The weight of the structure.
- (b) Superimposed dead load including the weight of pavement and backfill.
- (c) An allowance for a future wearing surface as shown on the Design Plans or 60 psf if no criteria is shown.
- (d) Horizontal earth pressures applied to the sides of the structure based on a minimum equivalent fluid pressure of 40 lb/ft3 (6.3 kN/m3).
- (e) The live load plus impact shown on the Design Plans for the structure, or HL-93 in accordance with the AASHTO LRFD Bridge Design Specifications, if no live load design criteria is shown on the Design Plans.

(10) Wingwalls and headwalls shall be designed based on a minimum equivalent fluid pressure of 40 lb/ft3 (6.3 kN/m3). Horizontal pressures shall be increased for sloping backfill surfaces and live load surcharge. Footings shall be designed for the allowable soil bearing shown on the plans. Wingwalls and wingwall footings shall be designed in accordance with the soil parameters shown on the plans. Wingwall footings and headwall connections shall be checked for sliding and for overturning utilizing a factor of safety of 1.5 in accordance with KYTC Guidance Manual SD-405. Headwalls with bridge rail mounted on top and the anchorage of the headwall to the structure section shall be designed for AASHTO traffic railing loadings. Continuity shall be established between the structure footing and the wingwall footing.

(11) The cover dimension over the top mat of reinforcement shall be a minimum of 2 in. (50 mm). The cover over the lower mat of reinforcement in the structure top shall be a minimum of 1.5 in. (40 mm). The clear distance of the end circumferential reinforcement shall not be less than 1 in. (25 mm) nor more than 2 in. (50 mm) from the ends of the structure section. The ends of the longitudinal distribution reinforcement shall not be more than 2 in. (50 mm) from the ends of the structure section.

(12) Cover for wingwall, pedestal, and headwall reinforcement shall be a minimum of 2 in. (50 mm). Cover for footing and base slab reinforcement shall be 3 in. (75 mm) for the top and sides and 4 in.(100 mm) for the bottom.

(13) Except as noted herein, reinforcing steel splicing and spacing requirements shall be in accordance with the AASHTO document shown on the General Plan for the structure or the AASHTO LRFD Bridge Design Specifications if no AASHTO document is shown. Tension splices in circumferential reinforcement shall be made by lapping. Deformed billet steel bars used for longitudinal distribution reinforcement shall have a center to center spacing not to exceed 12 in. The maximum spacing for wingwall reinforcing steel shall be 18 in. (450 mm) for horizontal bars and 12 in. (300 mm) for vertical bars. Exterior corner reinforcement in the bridge units shall be fully developed beyond the point where it is no longer required to resist flexure.

(14) Weep holes shall be included in the structure and wingwalls in accordance with KYTC Standard Specification 610.03.03.

(15) Wingwall sections are designed as self supporting sections. Connections to the structure or adjacent wingwall sections do not carry any calculated forces and are for continuity only.

MANUFACTURE

(16) Handling devices or holes will be permitted in each structure or wingwall section. However, not more than six holes shall be cast or drilled in each section. Cast holes shall be tapered.

(17) The section ends shall be of such design and shall be so formed that when the structure sections are erected, they shall make a continuous line of structure with a smooth interior free of irregularities.

(18) The structure sections and wingwalls shall be free of fractures. Exposed edges of precast elements shall be beveled ¾". The ends of the structure sections shall be normal to the walls and centerline, except where beveled ends are specified. The surface of the structure section shall be a smooth steel form or troweled surface. Trapped air pockets causing surface defects shall be considered as part of a smooth steel form finish.

(19) Wingwalls shall be given a finish in accordance with KYTC Standard Specification 601.03.18(A).

(20) The structure units shall not be stored in an upright position until the designated handling and storage compressive strength, as shown on the shop drawings, has been achieved.

(21) Each structure section and wingwall shall be clearly marked with waterproof paint. The following information shall be shown on the inside face of each wingwall and on a vertical leg of each structure section.

- (a) structure span and rise (structure sections only)
- (b) date of manufacture
- (c) name or trademark of the manufacturer
- (d) design earth cover

TESTING AND INSPECTION

(22) Concrete compressive strength shall be determined from compression tests made on cylinders or cores. For cylinder testing, a minimum of four cylinders shall be taken during each production run. For core testing, one core shall be cut from three structure sections selected at random from each group of 15 structure sections or less of a particular size and production run. One core shall be cut from each group of four or fewer wingwalls. For each continuous production run, each group of 15 structure sections of a single size or fraction thereof or four wingwalls shall be considered separately for the purpose of testing and acceptance. A production run shall be considered continuous if not interrupted for more than three consecutive days.

(23) Cylinders shall be made and tested in accordance with ASTM C 39. Cores shall be obtained and tested for compressive strength in accordance with ASTM C 497 (ASTM C 497M).

(24) The compressive strength of the concrete cylinders tested in each group of sections as defined above will be acceptable when the average core test strength is equal to or greater than the design concrete strength, not more than 10% of the cylinders tested have a compressive strength less than the design concrete strength, and no cylinder tested has a compressive strength less than 80% of the design concrete strength.

(25) If the compressive strength of the cylinders tested does not meet the above requirements, the acceptability of the production run may be determined by testing cores from the structure section or wingwall. The production group is acceptable if the average core concrete strength is greater than the design concrete strength. When the compressive strength of the core tested is less than the design concrete strength, the precast element from which that core was taken may be recored. If the compressive strength of the recore is equal to or greater than the design concrete strength, the compressive strength of the concrete in that group of sections will be acceptable.

(26) The core holes shall be plugged and cured by the manufacturer in such a manner that the structure will meet all the test requirements of these specifications. Structure sections or wingwalls repaired accordingly will be considered satisfactory for use.

(27) The manufacturer shall furnish all facilities, equipment, and personnel necessary to conduct the required testing.

(28) Structure sections or wingwalls shall be considered acceptable based on meeting the above test results subject to the following exceptions.

- (a) fractures or cracks passing through the wall, except for a single end crack which does not exceed one half the thickness of the wall;
- (b) defects which indicate proportioning, mixing, or molding which are not in accordance with this specification;
- (c) honeycombed or open texture; or
- (d) damaged section ends, where such damage prevents making a satisfactory joint

(29) Structure sections or wingwalls may be repaired, if necessary, due to imperfections in manufacture, handling damage, or construction. Repairs will be acceptable if it is determined that the repairs are sound, properly finished and cured, and if the repaired structure section or wingwall is in accordance with the requirements herein.

INSTALLATION

(30) The soils in the bottom of the excavation shall be compacted to 95% of the maximum dry density. If 95% of the maximum dry density cannot be obtained in the bottom of the excavation or in other areas, the KYTC and/or their geotechnical representative shall be contacted for additional recommendations. If during construction, soft soils are encountered at depths that make removal impractical, KYTC and/or their geotechnical representative shall be contacted for additional recommendations.

(31) Footings may be cast-in-place or precast. When a precast footing is utilized, a 4 in. (100 mm) layer of uniformly compact sand shall be placed under the full width of the footing. All footings shall be given a floated surface finish in accordance with KYTC Standard Specification 601.03.18(C). The footing concrete shall reach a compressive strength of 2,500 psi (17 500 kPa) before placement of the structure sections or wingwalls. The surface shall not vary more than 1/4 in. in 10 ft (6 mm in 3 m) when tested with 10 ft (3 m) straightedge.

(32) When a reinforced concrete pedestal is required between the base of the structure leg and the top of the footing, the Contractor shall have the option of providing a structure with extended legs or constructing the pedestals.

(33) The structure sections and wingwalls shall be set on masonite. A minimum gap of 0.5 in. (13 mm) shall be provided between the footing and the bottom of each section or wingwall. The gap shall be filled with a mortar in accordance with KYTC Standard Specifications Section 601. Structure legs shall be grouted or adequately restrained prior to applying any loads to the top of the culvert.

(34) The structure sections with less than 3 ft (0.9 m) of cover shall be produced with a minium 4 in. (100 mm) deep by 1.5 in. (40 mm) wide keyway joint. Structures with 3 ft (0.9 m) or more of cover may be produced with either the above keyway or butt joints. Mortar in accordance with KYTC Standard Specifications Section 601 shall be placed in the keyway joint.

(35) All butt joints between structure sections shall be covered with a external joint wrap in accordance with ASTM C 877 (ASTM C 877M), type II. The surface shall be free of dirt before the joint material is applied. The entire joint shall be continuously covered. Joints between structure sections and wingwalls and between structure sections and headwalls shall be covered with either the same wrap used between structure sections or with geotextile in accordance with KYTC Standard Specifications Section 214.

(36) The external joint wrap shall be kept in its proper location over the joint and care shall be taken to prevent damage during the backfilling operation.

(37) Drilled holes for handling shall be filled in accordance with the applicable provisions of KYTC Standard Specifications Section 601. Prior to backfilling the structure, all holes shall be covered with joint wrap material with a minimum width of 9 in. (225 mm).

(38) Structure backfill shall be placed and compacted in accordance with KYTC Standard Drawing RDI-120-03.

(39) When the level of structure backfill reaches the top of the structure, two lifts shall be spread and hand compacted over the structure without traversing the structure with heavy equipment. Compaction with heavy equipment will not be allowed until a minimum of two lifts have been placed, hand compacted, and tested.

(40) Structure backfill shall be placed and compacted to the same elevation on both sides of the structure before proceeding to the next layer.

(41) When the height of cover as shown on the plans is 12 in. (300 mm) or less, the structure under the paved portion of the roadway and shoulders shall be backfilled with flowable fill to the top of the vertical leg of the structure.

(42) The operation of equipment over the structure shall be in accordance with the structure manufacturer's recommendations.

HY-SPAN® The Instant Bridge

Sym.	Revisions	Date

Designed: SJC
Drawn: AJE/MAM
Checked: SJC
Scale: As Noted
Date: 2/24/12

HY-SPAN BRIDGE SYSTEM

GENERAL NOTES AND SPECIFICATIONS

HY-SPAN SYSTEMS, INC. / A SUBSIDIARY OF INDEPENDENT CONCRETE PIPE CO.

	TELEPHONE
SALES OFFICES	LOUISVILLE, KY (502)448-2920 INDIANAPOLIS, IN (317)262-4920 MISHAWAKA, IN (219)259-5401 ST. LOUIS, MO (314)842-2900 TOLEDO OH (419)841-3361

Project No:

Sheet No: 5 of 5

SUMMARY OF AVAILABLE THREE-SIDED SHAPES[1]							
SPAN (ft)	RISE (ft)	NOMINAL[2] AREA (sf)	MANUFACTURER[3]				Predefined[4] Shape No. (HY8 v7.3)
			Aqua-Arch	Conspan	Ecospan (AB)	Hy-Span	
12	4	42	-	X (42)	-	-	1 (41)
	5	54	-	X (54)	-	-	5 (53)
	6	66	-	X (66)	-	-	9 (65)
	7	78	-	X (78)	-	-	13 (77)
	8	90	-	X (90)	-	-	17 (89)
	9	102	-	X (102)	-	-	21 (101)
	10	114	-	X (114)	-	-	25 (113)
14	4	50	-	X (50)	-	X (53)	1 (48)
	5	64	-	X (64)	-	-	5 (62)
	6	78	-	X (78)	-	X (81)	9 (76)
	7	92	-	X (92)	-	-	13 (90)
	8	106	-	X (106)	-	X (109)	17 (104)
	9	120	-	X (120)	-	-	21 (118)
	10	134	-	X (134)	-	X (137)	25 (132)
	11	148	-	X (148)	-	-	U (148)
16	4	55	-	-	X (55)	X (61)	1 (54)
	5	71	X (71)	X (71)	X (71)	-	5 (70)
	6	87	X (87)	X (87)	X (87)	X (93)	9 (86)
	7	103	X (103)	X (103)	X (103)	-	13 (102)
	8	119	X (119)	X (119)	X (119)	X (125)	17 (118)
	9	135	X (135)	X (135)	X (135)	-	21 (134)
	10	151	X (151)	X (151)	X (151)	X (157)	25 (150)
	11	167	-	-	X (167)	-	U (167)
	12	183	-	-	X (183)	-	U (183)
	13	199	-	-	X (199)	-	U (199)
	14	215	-	-	X (215)	-	U (215)
	15	231	-	-	X (231)	-	U (231)
18*	4	60	-	-	-	X (69)	-
	6	96	-	-	-	X (105)	-
	8	132	-	-	-	X (141)	-
	10	168	-	-	-	X (177)	-
20	4*	65	-	-	X (65)	X (77)	U (65)
	5	85	X (85)	X (85)	X (85)	-	1 (83)
	6	105	X (105)	X (105)	X (105)	X (117)	5 (103)
	7	125	X (125)	X (125)	X (125)	-	9 (123)
	8	145	X (145)	X (145)	X (145)	X (157)	13 (143)
	9	165	X (165)	X (165)	X (165)	-	17 (163)
	10	185	X (185)	X (185)	X (185)	X (197)	21 (183)
	11	205	X (205)	-	X (205)	-	25 (203)
	12	225	-	-	X (225)	-	U (224)
	13	245	-	-	X (245)	-	U (244)
	14	265	-	-	X (265)	-	U (264)
	15	285	-	-	X (285)	-	U (284)

SUMMARY OF AVAILABLE THREE-SIDED SHAPES[1]							
SPAN (ft)	RISE (ft)	NOMINAL[2] AREA (sf)	MANUFACTURER[3]				Predefined[4] Shape No. (HY8 v7.3)
			Aqua-Arch	Conspan	Ecospan (AB)	Hy-Span	
22*	4	70	-	-	-	X (85)	-
	6	112	-	-	-	X (129)	-
	8	156	-	-	-	X (173)	-
	10	200	-	-	-	X (217)	-
24	4*	76	-	-	X (72)	X (89)	U (75)
	5	95	X (95)	-	X (95)	-	1 (92)
	6	119	X (119)	X (119)	X (119)	X (137)	5 (116)
	7	143	X (143)	X (143)	X (143)	-	9 (140)
	8	167	X (167)	X (167)	X (167)	X (185)	13 (164)
	9	191	X (191)	X (191)	X (191)	-	17 (188)
	10	215	X (215)	X (215)	X (215)	X (233)	21 (212)
	11	239	X (239)	-	X (239)	-	25 (236)
	12	263	-	-	X (263)	-	U (262)
	13	287	-	-	X (287)	-	U (286)
	14	311	-	-	X (311)	-	U (310)
	15	335	-	-	X (335)	-	U (334)
26*	4	84	-	-	-	X (97)	-
	6	129	-	-	-	X (149)	-
	8	181	-	-	-	X (201)	-
	10	233	-	-	-	X (253)	-
28	4	92	-	-	-	X (105)	-
	5	115	-	-	X (111)	-	U (114)
	6	139	-	-	X (138)	X (161)	1 (136)
	7	167	-	-	X (167)	-	5 (164)
	8	195	-	X (195)	X (195)	X (217)	9 (192)
	9	223	-	X (223)	X (223)	-	13 (220)
	10	251	-	X (251)	X (251)	X (273)	17 (248)
	11	279	-	X (279)	X (279)	-	21 (276)
	12	307	-	-	X (307)	-	25 (304)
	13	335	-	-	X (335)	-	U (334)
	14	363	-	-	X (363)	-	U (362)
	15	391	-	-	X (391)	-	U (391)
30*	4	98	-	-	-	X (113)	-
	6	146	-	-	-	X (173)	-
	8	206	-	-	-	X (233)	-
	10	266	-	-	-	X (293)	-

SUMMARY OF AVAILABLE THREE-SIDED SHAPES[1]							
SPAN (ft)	RISE (ft)	NOMINAL[2] AREA (sf)	MANUFACTURER[3]				Predefined[4] Shape No. (HY8 v7.3)
			Aqua-Arch	Conspan	Ecospan (AB)	Hy-Span	
32	4*	103	-	-	-	X (122)	-
	6*	155	-	-	X (153)	X (185)	-
	7	183	-	-	X (184)	-	1 (179)
	8	215	-	X (216)	X (216)	X (249)	5 (211)
	9	247	-	X (248)	X (248)	-	9 (243)
	10	279	-	X (280)	X (280)	X (313)	13 (275)
	11	311	-	X (312)	X (315)	-	17 (307)
	12	343	-	X (344)	X (344)	-	21 (339)
	13	375	-	-	X (376)	-	25 (371)
	14	407	-	-	X (408)	-	U (406)
	15	439	-	-	X (440)	-	U (438)
34*	4	108	-	-	-	X (122)	-
	6	163	-	-	-	X (190)	-
	8	224	-	-	-	X (258)	-
	10	292	-	-	-	X (326)	-
36	6*	171	-	-	-	X (202)	-
	7*	207	-	-	X (197)	-	U (198)
	8	232	-	-	X (232)	X (274)	1 (277)
	9	268	-	X (268)	X (268)	-	5 (263)
	10	304	-	X (304)	X (304)	X (346)	9 (299)
	11	340	-	X (340)	X (340)	-	13 (335)
	12	376	-	X (376)	X (376)	X (418)	17 (371)
	13	412	-	X (412)	X (412)	-	21 (407)
	14	448	-	-	X (448)	-	25 (443)
	15	484	-	-	X (484)	-	-
38*	8	238	-	-	-	X (290)	-
	10	314	-	-	-	X (366)	-
40*	8	249	-	-	-	X (306)	-
	10	324	-	-	-	X (386)	-
42 EC	8*	260	-	-	X (271)	-	U (259)
	9*	293	-	-	X (313)	-	U (291)
	10	333	-	X (334)	-	-	1 (325)
	11	375	-	X (376)	-	-	5 (367)
	12	417	-	X (418)	-	-	9 (409)
	13	459	-	X (460)	-	-	13 (451)
	14	501	-	X (502)	-	-	17 (493)
42 New (HY8)	10	333	-	-	X (355)	-	1 (353)
	11	375	-	-	X (397)	-	5 (395)
	12	417	-	-	X (439)	-	9 (437)
	13	459	-	-	X (481)	-	13 (479)
	14	501	-	-	X (523)	-	17 (521)
	15	543	-	-	X (565)	-	21 (563)

SUMMARY OF AVAILABLE THREE-SIDED SHAPES[1]							
SPAN (ft)	RISE (ft)	NOMINAL[2] AREA (sf)	MANUFACTURER[3]				Predefined[4] Shape No. (HY8 v7.3)
			Aqua-Arch	Conspan	Ecospan (AB)	Hy-Span	
48	9*	335	-	-	X (340)	-	U (333)
	10	372	-	X (387)	X (387)	-	3 (404)
	11	414	-	X (435)	X (435)	-	7 (452)
	12	462	-	X (483)	X (483)	-	11 (500)
	13*	510	-	-	X (531)	-	15 (548)
	14*	558	-	-	X (579)	-	19 (596)
	15*	606	-	-	X (627)	-	23 (644)
54	10	418	-	X (437)	X (437)	-	3 (434)
	11	460	-	X (491)	X (491)	-	7 (487)
	12	504	-	X (545)	X (545)	-	11 (540)
	13	558	-	X (599)	X (599)	-	15 (593)
	14	612	-	X (653)	X (653)	-	19 (646)
	15*	666	-	-	X (707)	-	23 (699)
60*	12	558	-	X (575)	X (575)	-	11 (575)
	13	604	-	X (635)	X (635)	-	15 (634)
	14	662	-	X (695)	X (695)	-	19 (693)
	15	722	-	-	X (755)	-	23 (752)
70*	12	650	-	-	X (647)	-	U (647)
	13	705	-	-	X (717)	-	U (701)
	14	759	-	-	X (787)	-	U (755)
	15	813	-	-	X (857)	-	U (809)
80*	12	743	-	-	X (704)	-	U (739)
	13	805	-	-	X (783)	-	U (801)
	14	867	-	-	X (862)	-	U (863)
	15	929	-	-	X (942)	-	U (924)

NOTES:

1. Tabulated spans and rises are based on the available shapes from preapproved manufacturers. Aqua-Arch, Conspan and Ecospan (AB series) structures are considered equivalent structures for the same span and rise. Hy-Span shapes are considered similar structures and may be substituted with other structures on that line. Other Ecospan and Bebo structures are not included in this table due to their variance from the shapes provided in this table. Any shape produced by an approved manufacturer may be denoted as similar if submitted to and approved by the Drainage Branch prior to use.
2. Nominal areas are the total flow areas for each of the predefined shapes in HECRAS, version 4.1.0. as calculated by KYTC. These values should closely match the values supplied by the manufacturer for the same shape. Refer to design policy for variances.
3. These entries represent the shapes that are available from each manufacturer. The flow area of the structure is listed as an aid in structure selection.
4. These entries identify the predefined HY8 shapes and areas. “U” denotes the availability of KYTC defined user shapes based on the predefined HECRAS geometries.

* - Shape was created in HECRAS by interpolation, stretching or extension of available shapes.