EVALUATION REPORT

ON

STEELMASTER ARCH PANELS

FOR FLORIDA PRODUCT APPROVAL

FL15623-R3

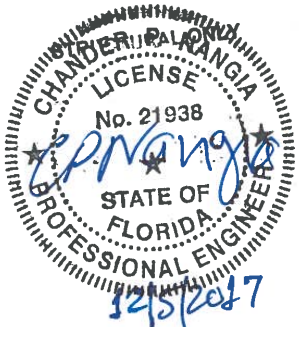
FLORIDA BUILDING CODE 2017

Compliance Method: Statewide Product Approval Rule 61G20-3.005(2)(b)
Category: Structural Components
Sub - Category: Structural Wall Components
(20 psf Live Load, 200 mph, HVHZ)

Manufacturer
Future Steel Buildings Intl. Corp.
220 Chrysler Drive
Brampton, ON L6S 6B6

Evaluated by
Chander P. Nangia, Florida PE # 21938
7423 Hollow Ridge Dr.
Houston, TX 77095

Report: FL_Evaluation_17



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1. Statement of Compliance

Based on evaluation of the technical documentation, it is concluded that the SteelMaster arch panels are in compliance with the requirements of the 2017 Florida Building Code for High-Velocity Hurricane Zones (HVHZ).

2. Product Description

SteelMaster arch panels are made of 22-gage ASTM A792 Grade 80 AZ60 steel sheet, function as both the structural components and the envelope of the arch-type structures. SteelMaster arch panel cross section is shown in Figure 1.

3. Technical Documentation

3.1 Design Criteria and Method

AISI Specification [1], ASCE 7 [2], and Florida Building Code 2017 [3] have been used to design SteelMaster arch panels. As listed in Sections 3.4 and 3.5, a total of 14 basic load cases and 55 load combinations have been taken into account in the design.

3.2 Design Data

- Live Load : roof live load of 20 psf
- Snow Load: Ground snow of 0 psf, partially exposed, cold roof
- Wind Load: Ultimate 3-second gust wind speed of 200 mph, HVHZ, exposure C, partially enclosed

3.3 Summary of Key Results

The key design results are summarized in Figure 2. Since the maximum interaction factor for all of the arch panels and 55 load combinations is 0.872, these arch panels can safely resist all the loads and load combinations required by the 2017 Florida Building Code for HVHZ.

3.4 Basic Loads

SteelMaster arch panels are designed for the following 14 basic load cases. The two letter basic load ID will be used for load combinations in Section 3.5.

1. **DL** Self-weight of the building, according to the steel panel thickness.
2. **LU** Uniform roof live load, minimum of 20 psf for flat roof.
3. **LL** Roof live load applied on the left side of the roof.
4. **LR** Roof live load applied on the right side of the roof.
5. **SB** Balanced snow load on the whole roof.
6. **SPL** Partial snow load on the left side of the roof.
7. **SPR** Partial snow load on the right side of the roof.
8. **SL** Unbalanced snow load on the left side of the roof.
9. **SR** Unbalanced snow load on the right side of the roof.
10. **WL** External wind from the left side of the building.
11. **WR** External wind from the right side of the building.
12. **WA** External wind in the building length direction.
13. **WP** Positive internal wind pressure.
14. **WN** Negative internal wind pressure.

3.5 Load Combinations

Every SteelMaster arch panel is designed for the following 55 load combinations (please see Section 3.4 for basic load ID):

1. 1.4 DL
2. 1.2 DL + 1.6 LU
3. 1.2 DL + 1.6 LL
4. 1.2 DL + 1.6 LR
5. 1.2 DL + 1.6 SB
6. 1.2 DL + 1.6 SPL
7. 1.2 DL + 1.6 SPR
8. 1.2 DL + 1.6 SL
9. 1.2 DL + 1.6 SR
10. 0.9 DL + 1.0 WL + 1.0 WP
11. 0.9 DL + 1.0 WL + 1.0 WN
12. 0.9 DL + 1.0 WR + 1.0 WP
13. 0.9 DL + 1.0 WR + 1.0 WN
14. 0.9 DL + 1.0 WA + 1.0 WP
15. 0.9 DL + 1.0 WA + 1.0 WN
16. 1.2 DL + 1.6 LU + 0.5 WL + 0.5 WP
17. 1.2 DL + 1.6 LU + 0.5 WL + 0.5 WN
18. 1.2 DL + 1.6 LU + 0.5 WR + 0.5 WP
19. 1.2 DL + 1.6 LU + 0.5 WR + 0.5 WN
20. 1.2 DL + 1.6 LL + 0.5 WL + 0.5 WP
21. 1.2 DL + 1.6 LL + 0.5 WL + 0.5 WN
22. 1.2 DL + 1.6 LL + 0.5 WR + 0.5 WP
23. 1.2 DL + 1.6 LL + 0.5 WR + 0.5 WN
24. 1.2 DL + 1.6 LR + 0.5 WL + 0.5 WP
25. 1.2 DL + 1.6 LR + 0.5 WL + 0.5 WN
26. 1.2 DL + 1.6 LR + 0.5 WR + 0.5 WP

27. 1.2 DL + 1.6 LR + 0.5 WR + 0.5 WN
28. 1.2 DL + 1.6 SB + 0.5 WL + 0.5 WP
29. 1.2 DL + 1.6 SB + 0.5 WL + 0.5 WN
30. 1.2 DL + 1.6 SB + 0.5 WR + 0.5 WP
31. 1.2 DL + 1.6 SB + 0.5 WR + 0.5 WN
32. 1.2 DL + 1.6 SPL + 0.5 WL + 0.5 WP
33. 1.2 DL + 1.6 SPL + 0.5 WL + 0.5 WN
34. 1.2 DL + 1.6 SPR + 0.5 WR + 0.5 WP
35. 1.2 DL + 1.6 SPR + 0.5 WR + 0.5 WN
36. 1.2 DL + 1.6 SL + 0.5 WR + 0.5 WP
37. 1.2 DL + 1.6 SL + 0.5 WR + 0.5 WN
38. 1.2 DL + 1.6 SR + 0.5 WL + 0.5 WP
39. 1.2 DL + 1.6 SR + 0.5 WL + 0.5 WN
40. 1.2 DL + 0.5 LU + 1.0 WL + 1.0 WP
41. 1.2 DL + 0.5 LU + 1.0 WL + 1.0 WN
42. 1.2 DL + 0.5 LU + 1.0 WR + 1.0 WP
43. 1.2 DL + 0.5 LU + 1.0 WR + 1.0 WN
44. 1.2 DL + 0.5 LL + 1.0 WL + 1.0 WP
45. 1.2 DL + 0.5 LL + 1.0 WL + 1.0 WN
46. 1.2 DL + 0.5 LL + 1.0 WR + 1.0 WP
47. 1.2 DL + 0.5 LL + 1.0 WR + 1.0 WN
48. 1.2 DL + 0.5 LR + 1.0 WL + 1.0 WP
49. 1.2 DL + 0.5 LR + 1.0 WL + 1.0 WN
50. 1.2 DL + 0.5 LR + 1.0 WR + 1.0 WP
51. 1.2 DL + 0.5 LR + 1.0 WR + 1.0 WN
52. 1.2 DL + 0.5 SB + 1.0 WL + 1.0 WP
53. 1.2 DL + 0.5 SB + 1.0 WL + 1.0 WN
54. 1.2 DL + 0.5 SB + 1.0 WR + 1.0 WP
55. 1.2 DL + 0.5 SB + 1.0 WR + 1.0 WN

3.6 References

1. American Iron and Steel Institute, “AISI Standard: AISI S100-2012, North American Specification for the Design of Cold-formed Steel Structural Members,” AISI, Washington, DC, 2nd Printing, June 2014.

2. American Society of Civil Engineers, “ASCE Standard, Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10),” ASCE, 2010.

3. State of Florida, “Florida Building Code, Sixth Edition (2017) - Building,” State of Florida, First Printing, July 2017.

3.7 Input File

```
STEEL ARCH MODEL: A20-12 (FBC-2017, 20 PSF LIVE, 200 MPH, HVHZ, PARTIALLY ENCLOSED)
SYSTEM
  DOF=UX,UZ,RY LENGTH=M FORCE=KN UP=+Z

JOINT
    1    X=   0.000  Z=   0.000
    2    X=   0.000  Z=   0.202
    3    X=   0.000  Z=   0.379
    4    X=   0.000  Z=   0.555
    5    X=   0.000  Z=   0.731
    6    X=   0.000  Z=   0.907
    7    X=   0.000  Z=   1.083
    8    X=   0.000  Z=   1.260
    9    X=   0.000  Z=   1.436
   10    X=   0.000  Z=   1.612
   11    X=   0.007  Z=   1.788
   12    X=   0.035  Z=   1.962
   13    X=   0.082  Z=   2.132
   14    X=   0.149  Z=   2.295
   15    X=   0.234  Z=   2.449
   16    X=   0.336  Z=   2.593
   17    X=   0.454  Z=   2.723
   18    X=   0.586  Z=   2.839
   19    X=   0.731  Z=   2.940
   20    X=   0.886  Z=   3.022
   21    X=   1.050  Z=   3.087
   22    X=   1.217  Z=   3.145
   23    X=   1.383  Z=   3.202
   24    X=   1.550  Z=   3.260
   25    X=   1.716  Z=   3.318
   26    X=   1.883  Z=   3.375
   27    X=   2.049  Z=   3.433
   28    X=   2.216  Z=   3.491
   29    X=   2.382  Z=   3.548
   30    X=   2.551  Z=   3.600
   31    X=   2.723  Z=   3.635
   32    X=   2.899  Z=   3.652
   33    X=   3.075  Z=   3.652
   34    X=   3.250  Z=   3.635
   35    X=   3.423  Z=   3.600
   36    X=   3.591  Z=   3.548
   37    X=   3.758  Z=   3.491
   38    X=   3.924  Z=   3.433
   39    X=   4.091  Z=   3.375
   40    X=   4.257  Z=   3.318
   41    X=   4.424  Z=   3.260
   42    X=   4.590  Z=   3.202
   43    X=   4.757  Z=   3.145
   44    X=   4.923  Z=   3.087
   45    X=   5.087  Z=   3.022
   46    X=   5.243  Z=   2.940
   47    X=   5.387  Z=   2.839
   48    X=   5.520  Z=   2.723
   49    X=   5.638  Z=   2.593
   50    X=   5.740  Z=   2.449
   51    X=   5.825  Z=   2.295
   52    X=   5.891  Z=   2.132
   53    X=   5.939  Z=   1.962
   54    X=   5.966  Z=   1.788
   55    X=   5.973  Z=   1.612
   56    X=   5.973  Z=   1.436
   57    X=   5.973  Z=   1.260
   58    X=   5.973  Z=   1.083
   59    X=   5.973  Z=   0.907
   60    X=   5.973  Z=   0.731
   61    X=   5.973  Z=   0.555
   62    X=   5.973  Z=   0.379
   63    X=   5.973  Z=   0.202
```

```
   64    X=   5.973  Z=   0.000

RESTRAINT
  ADD=  1  DOF=UX,UZ
  ADD= 64  DOF=UX,UZ

SPRING
  ADD=  1  RY= 183.3427
  ADD= 64  RY= 183.3427

MATERIAL
  NAME=CS TYPE=ISO M=7.85 W=77
  T=0 E=203E6 U=0.3 A=1.17E-5

FRAME SECTION
NAME=PANEL1 TYPE=PRISM MAT=CS A= 6459.E-07 I= 3267.E-09 SH=G
NAME=PANEL2 TYPE=PRISM MAT=CS A= 1866.E-07 I= 1168.E-09 SH=G
NAME=PANEL3 TYPE=PRISM MAT=CS A= 6459.E-07 I= 3267.E-09 SH=G
NAME=PANEL4 TYPE=PRISM MAT=CS A= 1866.E-07 I= 1168.E-09 SH=G
NAME=PANEL5 TYPE=PRISM MAT=CS A= 6459.E-07 I= 3267.E-09 SH=G
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 3  J= 3  4  SEC=PANEL1 NSEG=2
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 5  J= 5  6  SEC=PANEL1 NSEG=2
 6  J= 6  7  SEC=PANEL1 NSEG=2
 7  J= 7  8  SEC=PANEL1 NSEG=2
 8  J= 8  9  SEC=PANEL1 NSEG=2
 9  J= 9  10  SEC=PANEL1 NSEG=2
 10  J= 9  10  SEC=PANEL2 NSEG=2
CSYS=0 PLDIR=+Z,+X LOCAL=12
 11  J= 10  11  SEC=PANEL2 NSEG=2
 12  J= 11  12  SEC=PANEL2 NSEG=2
 13  J= 12  13  SEC=PANEL2 NSEG=2
 14  J= 13  14  SEC=PANEL2 NSEG=2
 15  J= 14  15  SEC=PANEL2 NSEG=2
 16  J= 15  16  SEC=PANEL2 NSEG=2
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 44  J= 40  41  SEC=PANEL5 NSEG=2
 45  J= 41  42  SEC=PANEL5 NSEG=2
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 65  J= 59  60  SEC=PANEL7 NSEG=2
 66  J= 60  61  SEC=PANEL7 NSEG=2
 67  J= 61  62  SEC=PANEL7 NSEG=2
 68  J= 62  63  SEC=PANEL7 NSEG=2
 69  J= 63  64  SEC=PANEL7 NSEG=2

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    TYPE=DISTRIBUTED SPAN
      ADD= 1  9   1  UZ=-7.910375E-02
      ADD= 10  22   1  UZ=-7.910375E-02
      ADD= 23  30   1  UZ=-7.910375E-02
      ADD= 31  39   1  UZ=-7.910375E-02
      ADD= 40  47   1  UZ=-7.910375E-02
      ADD= 48  60   1  UZ=-7.910375E-02
      ADD= 61  69   1  UZ=-7.910375E-02
  NAME=LU SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 10  21  1  UZP=-.57925
      ADD= 23  29  1  UZP=-.57925
      ADD= 31  39  1  UZP=-.57925
      ADD= 41  47  1  UZP=-.57925
      ADD= 49  60  1  UZP=-.57925
  NAME=LL SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 10  21  1  UZP=-.57925
      ADD= 23  29  1  UZP=-.57925
      ADD= 31  35  1  UZP=-.57925
  NAME=LR SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 35  39  1  UZP=-.57925
      ADD= 41  47  1  UZP=-.57925
      ADD= 49  60  1  UZP=-.57925
  NAME=SB SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  UZP= 0
  NAME=SPL SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  UZP= 0
  NAME=SPR SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  UZP= 0
  NAME=SL SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  UZP= 0
  NAME=SR SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  UZP= 0
  NAME=WL SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  8  1  U2=-1.12611
      ADD= 10  15  1  U2=-.56305
```

```
      ADD= 16  21  1  U2= .74403
      ADD= 23  29  1  U2= 1.48805
      ADD= 31  35  1  U2= 1.48805
      ADD= 35  39  1  U2= 1.02088
      ADD= 41  47  1  U2= 1.02088
      ADD= 49  60  1  U2= .96501
      ADD= 62  69  1  U2= .90915
  NAME=WR SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  8  1  U2= .90915
      ADD= 10  21  1  U2= .96501
      ADD= 23  29  1  U2= 1.02088
      ADD= 31  35  1  U2= 1.02088
      ADD= 35  39  1  U2= 1.48805
      ADD= 41  47  1  U2= 1.48805
      ADD= 49  54  1  U2= .74403
      ADD= 55  60  1  U2=-.56305
      ADD= 62  69  1  U2=-1.12611
  NAME=WA SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  8  1  U2= .97047
      ADD= 10  15  1  U2= .97047
      ADD= 16  21  1  U2= 1.48805
      ADD= 23  29  1  U2= 1.48805
      ADD= 31  35  1  U2= 1.48805
      ADD= 35  39  1  U2= 1.48805
      ADD= 41  47  1  U2= 1.48805
      ADD= 49  54  1  U2= 1.48805
      ADD= 55  60  1  U2= .97047
      ADD= 62  69  1  U2= .97047
  NAME=WP SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  9  1  U2= 1.18613
      ADD= 11  22  1  U2= 1.18613
      ADD= 24  30  1  U2= 1.18613
      ADD= 32  38  1  U2= 1.18613
      ADD= 40  46  1  U2= 1.18613
      ADD= 48  59  1  U2= 1.18613
      ADD= 61  69  1  U2= 1.18613
  NAME=WN SW=0
    TYPE=DISTRIBUTED SPAN
      ADD= 1  9  1  U2=-1.18613
      ADD= 11  22  1  U2=-1.18613
      ADD= 24  30  1  U2=-1.18613
      ADD= 32  38  1  U2=-1.18613
      ADD= 40  46  1  U2=-1.18613
      ADD= 48  59  1  U2=-1.18613
      ADD= 61  69  1  U2=-1.18613
END
```

3.8 Design Summary

```
              FUTURE STEEL ARCH BUILDING DESIGN PROGRAM (v. 9.1)
            Future Steel Buildings Intl. Corp. Copyright 1998-2017
  PROJECT NAME: FL PRODUCT APPROVAL                      PROJECT # FBC-2017
  File Name: C:\WORK\A2012FBC.DSN                        DEC-04-2017, 23:28:03
================================================================================

  SPECIFIED ARCH DESIGN PARAMETERS
  *******************************
  BUILDING LOCATION   = UNITED STATES
  ARCH TYPE           =   A                BASE TYPE              = BRACKET
  ARCH SPAN           =  19.67 ft          ARCH HEIGHT            =  11.96 ft
  FLAT ROOF LIVE LOAD =  20.00 psf         GROUND SNOW            =   0.00 psf
  THERMAL COEFFICIENT =   1.2              R-VALUE                =   0
  EXPOSURE CATEGORY   =   C                EXPOSURE DEGREE        = PARTIAL
  BUILDING CATEGORY   = III                COLLATERAL DEAD LOAD   =   1.00 psf
  ENCLOSURE CLASS     = PARTIALLY ENCLOSED 3-SEC. GUST WIND SPEED =   200  mph
```

```
DESIGN RESULTS
**************

SUMMARY OUTPUT FOR PANEL # 1
********************************************************************************
PANEL PROPERTIES
****************
  Fy   =  60.00 ksi            Fu   =  61.50 ksi          FUB  =  74.00 ksi
  Fyv  =  80.00 ksi            Fybn =  63.06 ksi          Fybp =  73.42 ksi
  t    =   0.03 in             H    =   7.50 in           DBOT =   0.31 in
  ANG1 =  45.00 deg.           ANG2 =  45.00 deg.         DHOL =   0.44 in
  ELBT =   7.50 in             ELTP =   1.50 in           DEND =   1.03 in
  ELIP =   0.89 in             NBRW =   8    Max./Row     PALN =   64.5 in
  WPAN =  18.92 lb             CDMX =   0.00 in

PANEL DESIGN RESULTS
********************
MAXIMUM INTERACTION FACTOR =  0.675           LOAD COMBINATION  =  11
STRENGTH INTERACTION FACTORS:
  IN COMPRESSION           =  0.013           IN TENSION        =   0.000
  IN   BENDING             =  0.482           IN  SHEAR         =   0.675
CRITICAL MEMBER NUMBER     =   1              CRITICAL SECTION  =  1
FACTORED AXIAL FORCE AND RESISTANCES:
  Pr   =    7.82 kip  Pro  =   10.26 kip  Tr   =   18.71 kip  Pf =   -0.10 kip
  UBKL =  18.297 ft   ELNC =  17.016 ft   FIXP =   0.500      EK =   0.930
FACTORED SHEAR FORCES AND RESISTANCES:
  Vr   =    1.35 kip  Vf   =    0.91 kip  Vb   =   30.65 kip  Vbf=    0.10 kip
FACTORED BENDING MOMENT AND RESISTANCES:
  Mrn =  2.64 kip-ft  Mrnb =  2.64 kip-ft Mrnt =  6.98 kip-ft Mf =-1.27 kip-ft
  Mrp =  4.29 kip-ft  Mrpb = 11.86 kip-ft Mrpt =  4.29 kip-ft Mrpo= 4.29 kip-ft

SUMMARY OUTPUT FOR PANEL # 2
********************************************************************************
PANEL PROPERTIES
****************
  Fy   =  60.00 ksi            Fu   =  61.50 ksi          FUB  =  74.00 ksi
  Fyv  =  80.00 ksi            Fybn =  80.00 ksi          Fybp =  73.42 ksi
  t    =   0.03 in             H    =   7.50 in           DBOT =   0.31 in
  ANG1 =  45.00 deg.           ANG2 =  45.00 deg.         DHOL =   0.44 in
  ELBT =   7.50 in             ELTP =   1.50 in           DEND =   1.03 in
  ELIP =   0.89 in             NBRW =   8    Max./Row     PALN =   92.0 in
  WPAN =  26.99 lb             CDMX =   0.28 in           RADS =   5.00 ft

PANEL DESIGN RESULTS
********************
MAXIMUM INTERACTION FACTOR =  0.872           LOAD COMBINATION  =  10
STRENGTH INTERACTION FACTORS:
  IN COMPRESSION           =  0.000           IN TENSION        =   0.089
  IN   BENDING             =  0.870           IN  SHEAR         =   0.183
CRITICAL MEMBER NUMBER     =  14              CRITICAL SECTION  =  3
FACTORED AXIAL FORCE AND RESISTANCES:
  Pr   =    6.33 kip  Pro  =   11.51 kip  Tr   =   18.71 kip  Pf =    1.66 kip
  UBKL =  18.297 ft   ELNC =  21.041 ft   FIXP =   0.000      EK =   1.150
FACTORED SHEAR FORCES AND RESISTANCES:
  Vr   =   15.13 kip  Vf   =    0.06 kip  Vb   =   30.65 kip  Vbf=    1.66 kip
FACTORED BENDING MOMENT AND RESISTANCES:
  Mrn =  3.09 kip-ft  Mrnb =  3.09 kip-ft Mrnt =  8.09 kip-ft Mf = 2.21 kip-ft
  Mrp =  2.54 kip-ft  Mrpb =  2.82 kip-ft Mrpt =  3.11 kip-ft Mrpo= 2.54 kip-ft

SUMMARY OUTPUT FOR PANEL # 3
********************************************************************************
PANEL PROPERTIES
****************
  Fy   =  60.00 ksi            Fu   =  61.50 ksi          FUB  =  74.00 ksi
  Fyv  =  80.00 ksi            Fybn =  63.06 ksi          Fybp =  73.42 ksi
  t    =   0.03 in             H    =   7.50 in           DBOT =   0.31 in
  ANG1 =  45.00 deg.           ANG2 =  45.00 deg.         DHOL =   0.44 in
  ELBT =   7.50 in             ELTP =   1.50 in           DEND =   1.03 in
  ELIP =   0.89 in             NBRW =   8    Max./Row     PALN =   57.5 in
  WPAN =  16.87 lb             CDMX =   0.00 in
```

```
PANEL DESIGN RESULTS
********************
MAXIMUM INTERACTION FACTOR =  0.585            LOAD COMBINATION  =  12
STRENGTH INTERACTION FACTORS:
  IN COMPRESSION           =  0.000            IN TENSION        =   0.069
  IN   BENDING             =  0.585            IN  SHEAR         =   0.143
CRITICAL MEMBER NUMBER     =  29               CRITICAL SECTION  =  2
FACTORED AXIAL FORCE AND RESISTANCES:
  Pr   =    6.77 kip  Pro  =   10.26 kip  Tr   =   18.71 kip  Pf =    1.30 kip
  UBKL =  18.297 ft   ELNC =  21.041 ft   FIXP =   0.000      EK =   1.150
FACTORED SHEAR FORCES AND RESISTANCES:
  Vr   =    1.35 kip  Vf   =    0.01 kip  Vb   =   30.65 kip  Vbf=    1.30 kip
FACTORED BENDING MOMENT AND RESISTANCES:
  Mrn =  2.64 kip-ft  Mrnb =  2.64 kip-ft Mrnt =  6.98 kip-ft Mf =-1.55 kip-ft
  Mrp =  4.29 kip-ft  Mrpb = 11.86 kip-ft Mrpt =  4.29 kip-ft Mrpo= 4.29 kip-ft

SUMMARY OUTPUT FOR PANEL # 4
********************************************************************************
PANEL PROPERTIES
****************
  Fy   =  60.00 ksi            Fu   =  61.50 ksi           FUB  =  74.00 ksi
  Fyv  =  80.00 ksi            Fybn =  80.00 ksi           Fybp =  73.42 ksi
  t    =   0.03 in             H    =   7.50 in            DBOT =   0.31 in
  ANG1 =  45.00 deg.           ANG2 =  45.00 deg.          DHOL =   0.44 in
  ELBT =   7.50 in             ELTP =   1.50 in            DEND =   1.03 in
  ELIP =   0.89 in             NBRW =   8    Max./Row      PALN =   64.5 in
  WPAN =  18.92 lb             CDMX =   0.28 in            RADS =   5.81 ft

PANEL DESIGN RESULTS
********************
MAXIMUM INTERACTION FACTOR =  0.482            LOAD COMBINATION  =  10
STRENGTH INTERACTION FACTORS:
  IN COMPRESSION           =  0.000            IN TENSION        =   0.070
  IN   BENDING             =  0.482            IN  SHEAR         =   0.143
CRITICAL MEMBER NUMBER     =  38               CRITICAL SECTION  =  3
FACTORED AXIAL FORCE AND RESISTANCES:
  Pr   =    6.33 kip  Pro  =   11.51 kip  Tr   =   18.71 kip  Pf =    1.30 kip
  UBKL =  18.297 ft   ELNC =  21.041 ft   FIXP =   0.000      EK =   1.150
FACTORED SHEAR FORCES AND RESISTANCES:
  Vr   =   15.13 kip  Vf   =    0.09 kip  Vb   =   30.65 kip  Vbf=    1.30 kip
FACTORED BENDING MOMENT AND RESISTANCES:
  Mrn =  3.09 kip-ft  Mrnb =  3.09 kip-ft Mrnt =  8.09 kip-ft Mf =-1.49 kip-ft
  Mrp =  2.56 kip-ft  Mrpb =  2.82 kip-ft Mrpt =  3.11 kip-ft Mrpo= 2.56 kip-ft

SUMMARY OUTPUT FOR PANEL # 5
********************************************************************************
PANEL PROPERTIES
****************
  Fy   =  60.00 ksi            Fu   =  61.50 ksi           FUB  =  74.00 ksi
  Fyv  =  80.00 ksi            Fybn =  63.06 ksi           Fybp =  73.42 ksi
  t    =   0.03 in             H    =   7.50 in            DBOT =   0.31 in
  ANG1 =  45.00 deg.           ANG2 =  45.00 deg.          DHOL =   0.44 in
  ELBT =   7.50 in             ELTP =   1.50 in            DEND =   1.03 in
  ELIP =   0.89 in             NBRW =   8    Max./Row      PALN =   57.5 in
  WPAN =  16.87 lb             CDMX =   0.00 in

PANEL DESIGN RESULTS
********************
MAXIMUM INTERACTION FACTOR =  0.585            LOAD COMBINATION  =  10
STRENGTH INTERACTION FACTORS:
  IN COMPRESSION           =  0.000            IN TENSION        =   0.069
  IN   BENDING             =  0.585            IN  SHEAR         =   0.143
CRITICAL MEMBER NUMBER     =  41               CRITICAL SECTION  =  2
FACTORED AXIAL FORCE AND RESISTANCES:
  Pr   =    6.77 kip  Pro  =   10.26 kip  Tr   =   18.71 kip  Pf =    1.30 kip
  UBKL =  18.297 ft   ELNC =  21.041 ft   FIXP =   0.000      EK =   1.150
FACTORED SHEAR FORCES AND RESISTANCES:
  Vr   =    1.35 kip  Vf   =    0.01 kip  Vb   =   30.65 kip  Vbf=    1.30 kip
FACTORED BENDING MOMENT AND RESISTANCES:
  Mrn =  2.64 kip-ft  Mrnb =  2.64 kip-ft Mrnt =  6.98 kip-ft Mf =-1.55 kip-ft
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  Mrp =  4.29 kip-ft  Mrpb = 11.86 kip-ft Mrpt =  4.29 kip-ft Mrpo= 4.29 kip-ft

SUMMARY OUTPUT FOR PANEL # 6
********************************************************************************
PANEL PROPERTIES
****************
  Fy   =  60.00 ksi            Fu   =  61.50 ksi          FUB  =  74.00 ksi
  Fyv  =  80.00 ksi            Fybn =  80.00 ksi          Fybp =  73.42 ksi
  t    =   0.03 in             H    =   7.50 in           DBOT =   0.31 in
  ANG1 =  45.00 deg.           ANG2 =  45.00 deg.         DHOL =   0.44 in
  ELBT =   7.50 in             ELTP =   1.50 in           DEND =   1.03 in
  ELIP =   0.89 in             NBRW =   8    Max./Row     PALN =   92.0 in
  WPAN =  26.99 lb             CDMX =   0.28 in           RADS =   5.00 ft

PANEL DESIGN RESULTS
********************
MAXIMUM INTERACTION FACTOR =  0.872           LOAD COMBINATION  =  12
STRENGTH INTERACTION FACTORS:
  IN COMPRESSION           =  0.000           IN TENSION        =   0.089
  IN   BENDING             =  0.871           IN  SHEAR         =   0.182
CRITICAL MEMBER NUMBER     =  56              CRITICAL SECTION  =  1
FACTORED AXIAL FORCE AND RESISTANCES:
  Pr   =    6.33 kip  Pro  =   11.51 kip  Tr   =   18.71 kip  Pf =    1.66 kip
  UBKL =  18.297 ft   ELNC =  21.041 ft   FIXP =   0.000      EK =   1.150
FACTORED SHEAR FORCES AND RESISTANCES:
  Vr   =   15.13 kip  Vf   =    0.07 kip  Vb   =   30.65 kip  Vbf=    1.66 kip
FACTORED BENDING MOMENT AND RESISTANCES:
  Mrn =  3.09 kip-ft  Mrnb =  3.09 kip-ft Mrnt =  8.09 kip-ft Mf = 2.21 kip-ft
  Mrp =  2.54 kip-ft  Mrpb =  2.82 kip-ft Mrpt =  3.11 kip-ft Mrpo= 2.54 kip-ft

SUMMARY OUTPUT FOR PANEL # 7
********************************************************************************
PANEL PROPERTIES
****************
  Fy   =  60.00 ksi            Fu   =  61.50 ksi          FUB  =  74.00 ksi
  Fyv  =  80.00 ksi            Fybn =  63.06 ksi          Fybp =  73.42 ksi
  t    =   0.03 in             H    =   7.50 in           DBOT =   0.31 in
  ANG1 =  45.00 deg.           ANG2 =  45.00 deg.         DHOL =   0.44 in
  ELBT =   7.50 in             ELTP =   1.50 in           DEND =   1.03 in
  ELIP =   0.89 in             NBRW =   8    Max./Row     PALN =   64.5 in
  WPAN =  18.92 lb             CDMX =   0.00 in

PANEL DESIGN RESULTS
********************
MAXIMUM INTERACTION FACTOR =  0.675           LOAD COMBINATION  =  13
STRENGTH INTERACTION FACTORS:
  IN COMPRESSION           =  0.013           IN TENSION        =   0.000
  IN   BENDING             =  0.481           IN  SHEAR         =   0.675
CRITICAL MEMBER NUMBER     =  69              CRITICAL SECTION  =  3
FACTORED AXIAL FORCE AND RESISTANCES:
  Pr   =    7.82 kip  Pro  =   10.26 kip  Tr   =   18.71 kip  Pf =   -0.10 kip
  UBKL =  18.297 ft   ELNC =  17.016 ft   FIXP =   0.500      EK =   0.930
FACTORED SHEAR FORCES AND RESISTANCES:
  Vr   =    1.35 kip  Vf   =    0.91 kip  Vb   =   30.65 kip  Vbf=    0.10 kip
FACTORED BENDING MOMENT AND RESISTANCES:
  Mrn =  2.64 kip-ft  Mrnb =  2.64 kip-ft Mrnt =  6.98 kip-ft Mf =-1.27 kip-ft
  Mrp =  4.29 kip-ft  Mrpb = 11.86 kip-ft Mrpt =  4.29 kip-ft Mrpo= 4.29 kip-ft
================================================================================
        TOTAL STEEL WEIGHT OF ONE ARCH     = 144.475 lbs.
        MAXIMUM INTERACTION FACTOR IN ARCH =  0.872 AT MEMBER # 56
================================================================================

  ARCH BASE CONNECTION DESIGN SUMMARY
  ***********************************
  MAXIMUM FACTORED ARCH REACTIONS:
    Mmax =   1.42 kip-ft          Tmax =   1.70 kip          Vmax =   0.91 kip
  ARCH PANEL TO CONNECTOR BOLTS DESIGN:
    Connection Bolt Diameter =    3/8 in
    Connection Bolt Factored Tensile Strength =    150 ksi
    No. of Connection Bolts on Narrow Flange Side =   2.00
    No. of Connection Bolts on Wide Flange Side =   2.00
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    Factored Shear Capacity per Connection Bolt =   5.59 kip
    Factored Bearing Capacity per Connection Bolt =   1.23 kip
    Factored Tearing Out Capacity per Connection Bolt =   2.43 kip
    Factored Slip Resistance per Connection Bolt =   0.03 kip
    Maximum Interaction Factor for Connection Bolts =  0.586
    Corresponding Load Combination No. =     10
    Corresponding Arch Support No. =      1
    Corresponding Arch Base Moment =   1.42 kip-ft
    Corresponding Arch Base Shear Force =  -0.54 kip
    Corresponding Arch Base Axial Force =  -1.49 kip
  ANCHOR BOLT DESIGN PER ACI 318-14:
    Seismic Design Category = A
    Anchor Strengths in Uncracked Concrete
    Concrete Strength =   2.50 ksi
    Smallest Edge Distance =   2.75 in
    Minimum Embedment Depth =   8.75 in
    Minimum Foundation Depth =  12.75 in
    Anchor Type = Hilti Kwik Bolt 3 (ICC ESR-2302)
    Anchor Bolt Diameter =    5/8 in
    No. of Anchor Bolts on Narrow Flange Side =   1.00
    No. of Anchor Bolts on Wide Flange Side =   1.00
    Factored Anchor Bolt Tensile Strength =    106 ksi
    Maximum Interaction Factor for Anchor Bolts =  0.548
    Corresponding Load Combination No. =     12
    Corresponding Arch Support No. =      2
    Corresponding Arch Base Moment Reaction =  -1.42 kip-ft
    Corresponding Arch Base Shear Reaction =   0.54 kip
    Corresponding Arch Base Axial Reaction =  -1.49 kip
    Lowest Factored Tensile Strength per Anchor bolt =   6.36 kip
    Lowest Factored Shear Strength per Anchor bolt =   4.91 kip
    Factored Steel Strength of Anchor in Tension =  13.52 kip
    Factored Steel Strength of Anchor in Shear =   7.95 kip
    Factored Concrete Breakout Strength of Anchor in Tension =   6.36 kip
    Factored Concrete Breakout Strength of Anchor in Shear =   4.91 kip
    Factored Pullout Strength of Anchor in Tension =   6.85 kip
    Factored Concrete Pryout Strength of Anchor in Shear =  13.69 kip
  ARCH BRACKET STEEL THICKNESS = .105  in
    Minimum Factored Tensile Resistance per Arch Bracket =   8.32 kip
    Factored Pull-Over Resistance per Anchor Bolt =  10.30 kip
================================================================================
         MAXIMUM INTERACTION FACTOR INCLUDING ARCH BASE =  0.872
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4. Installation Requirements

SteelMaster arch panels shall be installed in accordance of the approved SteelMaster drawings and construction guidelines.

5. Limitations and Conditions of Use

Application of SteelMaster arch panels, including connection bolts, anchors, and horizontal loads shall be addressed on a case by case basis by a Professional Engineer licensed in Florida in accordance of the requirements of the latest edition of the Florida Building Code.

6. Certification of Independence

It is certified herein that:

1. The evaluator does not have, nor will acquire, a financial interest in any company manufacturing or distributing products for which the report is being issued, and
2. The evaluator does not have, nor will acquire, a financial interest in any other entity involved in the approval process of the products.

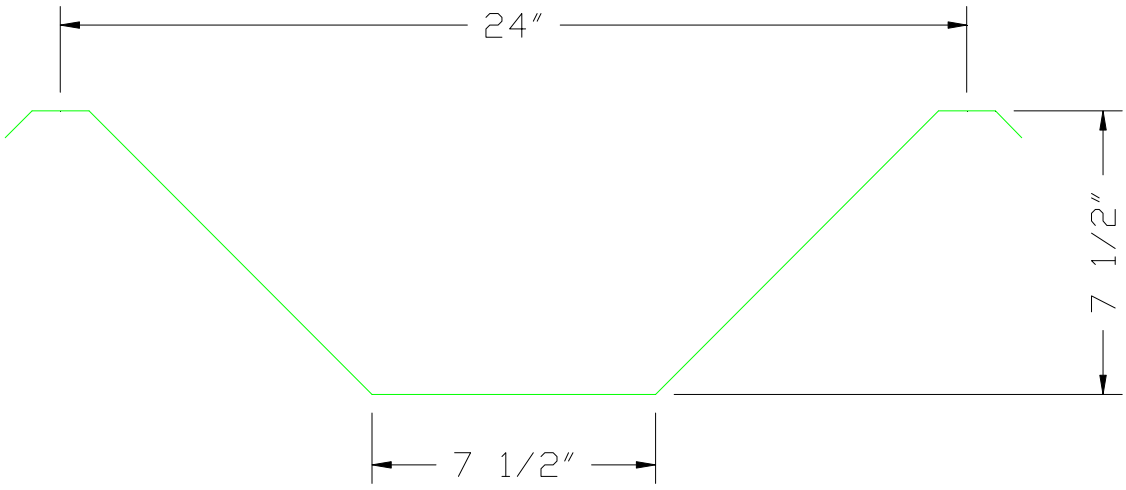

Figure 1. SteelMaster Arch Panel Cross Section

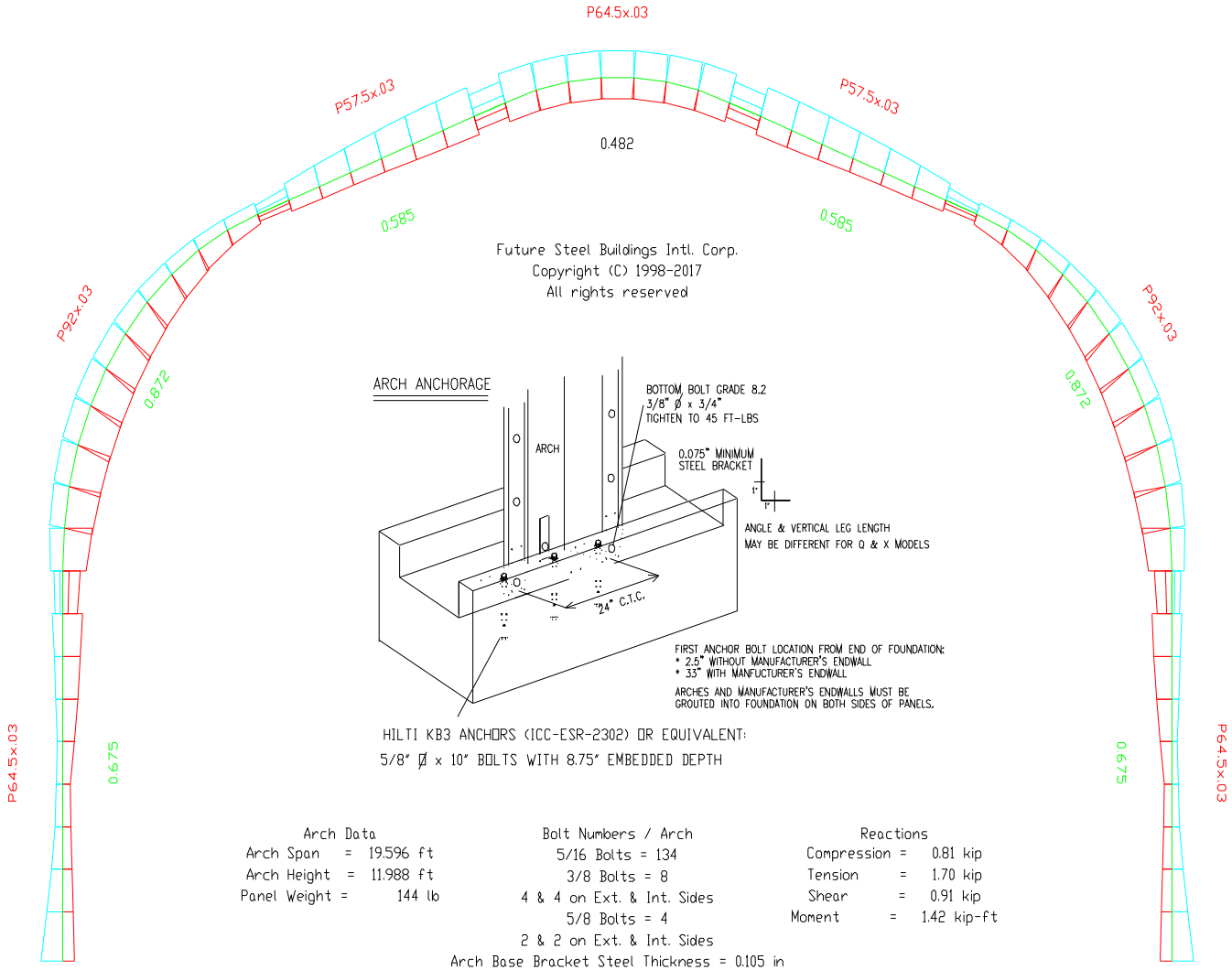

Figure 2. Moment Envelope, Panel Tags & Maximum Interaction Factors for A20-12 (20 psf Live, 200 mph, HVHZ, Partially Enclosed)

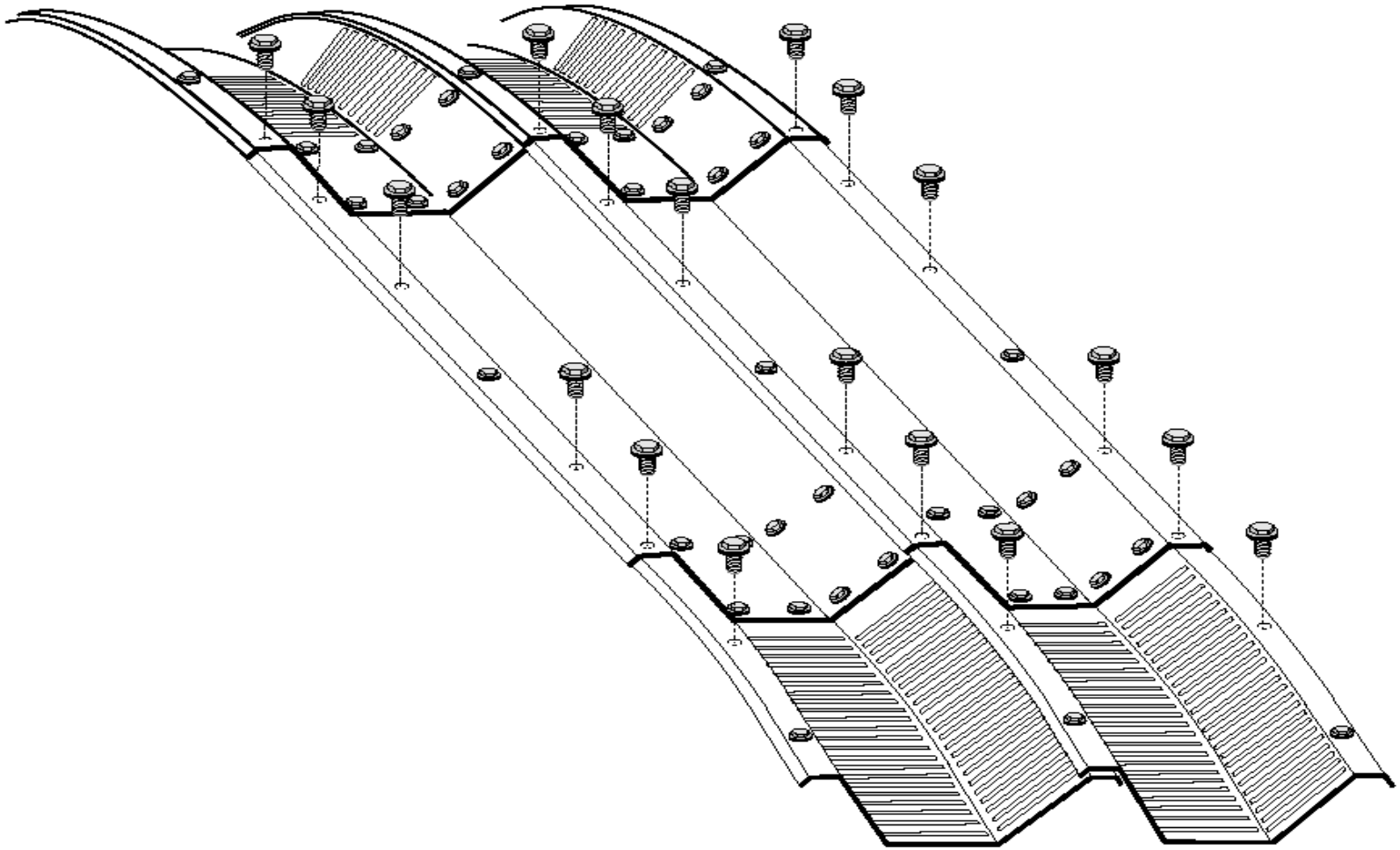

Figure 3. SteelMaster Arch Panel to Panel Connection with ASTM A307 5/16” Diameter Bolts and Nuts at 7” Spacing Along Panel Length (Washers not required)