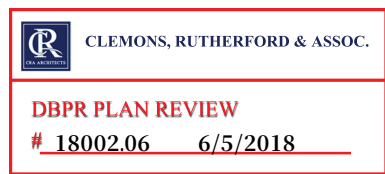


Engineering Calculations for:

Modular structure 24'x36'

Wind Speed: 186 MPH

ORB Project No. 1004.96



Julio Orbegoso, P.E.
License No. 38769
Date: 5/31/18



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CALCULATED BY: J.O.
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DESIGN CRITERIA:

1. FLORIDA BUILDING CODE 2017, BTH EDITION
2. ASCE 7-10 MINIMUM DESIGN LOADS FOR BUILDINGS
3. AISI SPECIFICATION FOR COLD FORMED METAL STEEL
4. AISC 14th EDITION
5. WIND SPEED: 136 MPH
6. SSMA TABLES
7. (2) 11'-8" WIDE MODULES
8. Flooring 3/4" armor mega-board or equiv.



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1. FLOOR JOIST:

TRY 600S162-68 (14 GA.) @2'-0", $F_y = 33 \text{ KSI}$
 $S_x = 1.772 \text{ in}^3$ $\text{SPAN} = 11' - 7\frac{1}{2}"$
 $I_x = 7.089 \text{ in}^4$ $M_{\text{allow}} = 35.60 \text{ K-in}$

LOAD D.L. = 10 PSF
 L.L. = 40 PSF TOTAL = 50 PSF

$$W_{D+L} = 50 \times 2 = 100 \text{ PLF}$$

$$M = \frac{0.1(11.63)^2}{8} = 1.69 \text{ K-ft} \times 12 \text{ in/ft}$$

$$M = 20.3 \text{ K-in} < 26.79 \text{ K-in} \dots \text{OK}$$

FROM SSMA TABLE, SINGLE SPAN MAX. DEFLECTION $L/360$

SPAN ALLOW = $12' - 5" > 11' - 7\frac{1}{2}" \dots \text{OK}$

USE FLOOR JOIST 600S162-68 (14 GA.) @2'-0" O.C.

2. WALL STUD:

TRY 362S200-43
 $S_x = 0.448 \text{ in}^3$
 $I_x = 0.836 \text{ in}^4$

FIRST 4'-0" FROM CORNER @12" O.C., HEIGHT = 9'-6"
 WIND COMP. & CLADDING (ZONE 5) $W = 54 \text{ PSF} \times 1 \text{ FT} = 54 \text{ PLF}$

$$M = \frac{54(9.5)^2}{8} = 0.609 \text{ K-ft}$$

$$S_{\text{req}} = \frac{0.609 \times 12}{0.6 \times 33} = 0.369 \text{ in}^3 \times 0.75 = 0.28 \text{ in}^3 < 0.448 \text{ in}^3 \dots \text{OK}$$

$$\Delta_{\text{max}} = \frac{9.5 \times 12}{300} = 0.38"$$

$$I_{\text{req}} = \frac{5 \times 0.054(9.5)^4 \times 1.728}{384 \times 29,000 \times 0.38} = 0.90 \times 0.75 = 0.67 \text{ in}^4 < 0.836 \text{ in}^4 \dots \text{OK}$$

USE STUD 362S200-43 @12" O.C. FOR 4'-0" FROM CORNER



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3. ROOF:

3.1) PURLIN 600S200-54 (16 GA) @2'-0" O.C. FIRST 4'-0" FROM THE END WALL

$$S_x = 1.106 \text{ in}^3$$

$$I_x = 3.31 \text{ in}^4$$

CLEAR SPAN = 11'-0"

CONTRIB. AREA: $A = 12' \times 2' = 24 \text{ SF}$.

$$\text{WIND ZONE 3 COMP. \& CLADDING} = \frac{(94.7 - 68.8)}{(50 - 20)} (24 - 20) = 3.5 \text{ PSF}$$

$$\text{FOR } A = 24 \text{ SF.} \rightarrow \text{WIND} = 94.7 - 3.5 = 91.2 \text{ PSF}$$

LESS DL = 5 PSF

$$\text{NET UPLIFT} = 86.2 \text{ PSF}$$

$$W = 86.2 \times 2 = 172.4 \text{ PLF}$$

$$M = \frac{172.4(11)^2}{8} = 2.61 \text{ K-ft}$$

$$S_{\text{req}} = \frac{2.61 \times 12}{0.6 \times 33} = 1.58 \text{ in}^3 \times 0.75 = 1.18 \text{ in}^3 > 1.106 \text{ in}^3 \text{ BY } 8\% \text{.....OK}$$

$$\Delta = \frac{L}{300} = \frac{11 \times 12}{300} = 0.44"$$

$$I_{\text{req}} = \frac{5 \times 0.172(11)^4 \times 1,728}{384 \times 29,000 \times 0.44} = 4.44 \times 0.75 = 3.33 \text{ in}^4 \approx 3.32 \text{ in}^4 \text{.....OK}$$

USE PURLIN 600S200-54 @2'-0" FIRST 4'-0" FROM END WALL

3.2) PURLINS @4'-0" FOR WIND ZONE 1

$$A = 4' \times 12' = 48 \text{ SF}$$

USE WIND PRESSURE = 43 PSF

$$W = 43 \times 4 = 172 \text{ PLF}$$

$$M = \frac{172(11)^2}{8} = 2.6 \text{ K-ft}$$

$$S_{\text{req}} = \frac{2.6 \times 12}{0.6 \times 36} = 1.45 \text{ in}^3 \times 0.75 = 1.08 \text{ in}^3 < 1.106 \text{ in}^3 \text{.....OK}$$

USE PURLIN 600S200-54 @4'-0" O.C. FOR WIND ZONE 1.



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3.3) ROOF EXTERIOR BEAM

MC8x8.5 $F_y = 36 \text{ KSI}$
 $S_y = 0.431 \text{ in}^3$
 $S_x = 5.82 \text{ in}^3$

SUPPORTS @ 9'-0" O.C.

D.L. = 10 PSF
L.L. = 40 PSF TOTAL = 50 PSF

$$W = 50(12/2) = 300 \text{ PLF}$$

$$M = \frac{0.3(9)^2}{8} = 3.0 \text{ K-ft}$$

$$S_{req} = \frac{3 \times 12}{0.6 \times 36} = 1.7 \text{ in}^3 < 5.82 \text{ in}^3 \text{.....OK}$$

3.4) AT ROOF MATE LINE

D.L. = 10 PSF
L.L. = 20 PSF TOTAL = 30 PSF

$$W = 30(12/2) = 180 \text{ PLF}$$

$$M = \frac{0.18(36)^2}{8} = 29.16 \text{ K-ft}$$

$$S_{req} = \frac{29.16 \times 12}{0.6 \times 36} = 16.2 \text{ in}^3$$

$$\Delta_{max} = \frac{L}{360} = \frac{36 \times 12}{360} = 1.2"$$

$$I_{req} = \frac{5 \times 0.18(36)^4 \times 1,728}{384 \times 29,000 \times 1.2} = 195.5 \text{ in}^4$$

USE MC12x31 ($S_x = 33.7 \text{ in}^3$, $I_x = 202 \text{ in}^4$) AT MATE LINE

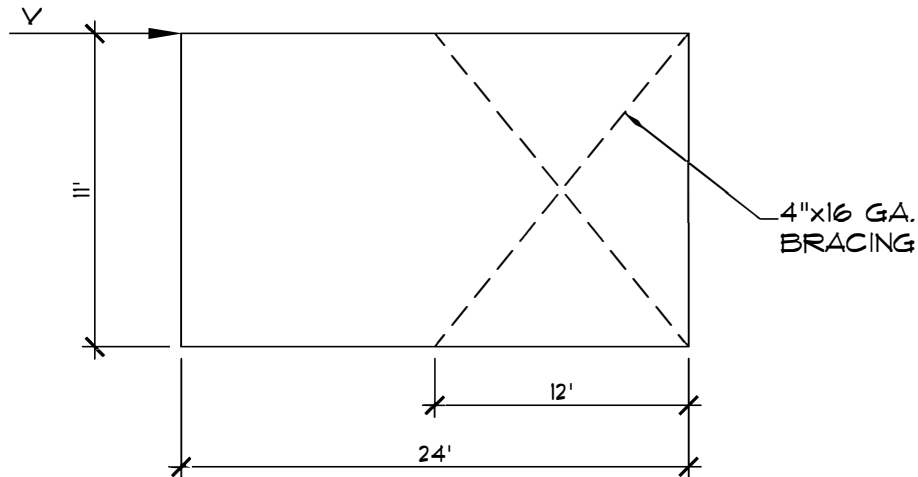


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4. SHEAR WALL



$$V = 33.0 \text{ PSF} \left(\frac{11}{2} \right) \left(\frac{36}{2} \right)$$

$$V = 3,267 \text{ #}$$

$$\frac{\text{u/ft}}{= \frac{3,267}{24}} = 136 \text{ PLF}$$

SHEAR WALL CAPACITY (FBC 2004, TAB. 2211.2(2))

FASTENER SPACING @7" O.C.

$$\text{CAPACITY} = 585 / 2.5 \text{ (SAFETY FACTOR)} = 234 \text{ PLF} > 136 \text{ PLF} \text{OK}$$

OVERTURNING SECTION

$$\text{Tot} = 3,267 \left(\frac{11}{24} \right) = 1,497 \text{ #}$$

TRY 3/16" WELDING 3" MIN. LENGTH (1/16" → 609 #/in)

$$\text{CAPACITY} = 3(609) = 1,827 \text{ #} (3) = 5,481 \text{ #} > 1,497 \text{ #} \text{ OK}$$

FASTENER TO BOTTOM TRACK

$$\text{SHEAR} = 33 \text{ PSF} \times 11 \times (36/2) = 6,534 \text{ #} / 24' = 272.3 \times 0.75 = 204 \text{ #/FT}$$

$$\#12 \text{ SCREWS @12" O.C.} \rightarrow \text{CAPACITY} = 280 \text{ #/FT} > 204 \text{ #/FT} \text{ OK}$$

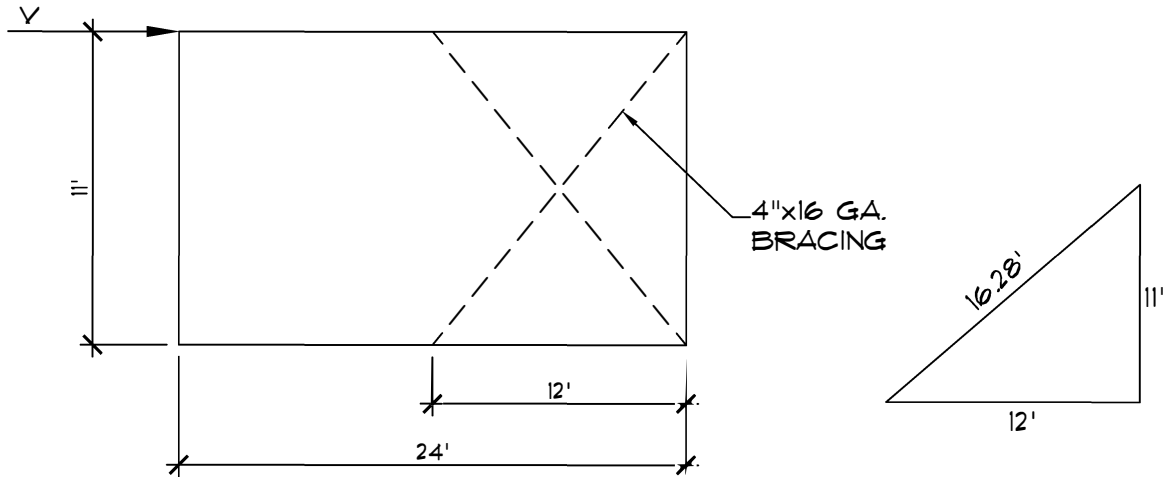


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5. END WALL DIAGONAL BRACING



(2) PLATES 4"x16 GA.

$$A = 4 \times 0.0598 \times 2 = 0.48 \text{ in}$$

$$\text{DIAGONAL TENSION} = 3,267 \left(\frac{16.28}{12} \right) = 4,432 * = 4.43 \text{ k}$$

$$A_{req} = \frac{4.43}{0.6 \times 33} = 0.22 \text{ in}^2 < 0.48 \text{ in}^2$$

END CONNECTION $\frac{1}{8}$ " MIN. 8" LENGTH EACH SIDE

$$\frac{1}{8} = \frac{2}{16}$$

$$\text{CAPACITY} = 2 \times 609 \times 8 \times 2 = 19,500 * > 4,432 *$$

USE 4"x16 GA. DIAGONAL BRACING WITH $\frac{1}{8}$ " FILLET WELDING x8" MIN. LENGTH



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6. FLOOR DECKING

LOAD D.L. = 10 PSF
 L.L. = 40 PSF

TOTAL D + L = 50 PSF

USE MEGABOARD STRUCTURAL CEMENT BOARD OR EQUIV.

CAPACITY = 100 PSF (SUPPORT @2'-0" O.C.) > 50 PSF (D.L. + L.L)

Dade County 175 mph Risk Category II
 Broward County 170 mph Risk Category II
<http://www.atcouncil.org/windspeed/>

Project: **ORB**

Date: **12-17-16**

Risk Category	III	Wind Speed Nominal	185 mph	area 1	80 sf	Bldg width	24
Exposure	C	V asd	145 mph	area 2	150 sf	Bldg length	36
Mean Roof Height	12 feet	Roof Slope	0.25:12	ASD factor	0.6	a=3'-0"	
Top of parapet	12 feet	Roof slope in degree	1.19	Enclosed		Monoslope	

(MWFRS DIRECTIONAL PROCEDURE) Chapter 27.2 Buildings of All Heights

MWFRS Walls direction 1 Normal to width				MWFRS Walls direction 2 Normal to length				MWFRS PARAPETS	
windward	leeward	sidewalls		windward	leeward	sidewalls		GCpi +	windward parapet
GCpi +	19.2	-20.0	-29.8	GCpi +	19.2	-23.2	-29.8	GCpi -	-38.3
GCpi -	33.0	-6.2	-16.0	GCpi -	33.0	-9.4	-16.0		leeward parapet

MWFRS Roof parallel to ridge				MWFRS Roof normal to ridge				MWFRS Roof Overhang	
horiz distance from windward edge				horiz distance from windward edge				GCpi +	
0	6	-36.2	7.0	0	6	-36.2	7.0	GCpi -	55.0
6	12	-36.2	7.0	6	12	-36.2	7.0		
12	24	-23.2	7.0	12	24	-23.2	7.0		
24		-16.7	7.0	24		-16.7	7.0		

MWFRS Min. Design Loads	
Walls	10.0
Roofs	5.0

(Components & Cladding Low Rise Buildings h<60) Chapter 30.4

Components and Cladding		Predefined Area								area 1		area 2	
		10	20	50	100	500	80	150					
Zone		+	+	+	+	+	+	+	+	+	+	+	+
1	GCpi +	4.6	-46.3	3.5	-44.1	2.0	-42.6	0.8	-41.5	1.1	-41.8	0.8	-41.5
	GCpi -	18.4	-31.5	17.3	-30.3	15.8	-28.8	14.6	-27.7	15.0	-28.0	14.6	-27.7
2	GCpi +	4.6	-76.0	3.5	-67.9	2.0	-57.2	0.8	-49.1	1.1	-51.7	0.8	-49.1
	GCpi -	18.4	-62.2	17.3	-54.1	15.8	-43.4	14.6	-35.3	15.0	-37.9	14.6	-35.3
3	GCpi +	4.6	-114.3	3.5	-84.7	2.0	-88.8	0.8	-49.1	1.1	-55.4	0.8	-49.1
	GCpi -	18.4	-100.5	17.3	-80.9	15.8	-54.9	14.6	-35.3	15.0	-41.8	14.6	-35.3
4	GCpi +	28.3	-44.2	26.5	-42.4	24.1	-40.0	22.3	-38.2	22.8	-38.8	21.2	-37.1
	GCpi -	40.7	-31.8	38.9	-30.0	36.5	-27.5	34.7	-25.7	30.4	-21.4	35.2	-24.7
5	GCpi +	28.3	-54.5	26.5	-50.9	24.1	-46.0	22.3	-42.4	18.0	-33.8	22.8	-43.6
	GCpi -	40.7	-42.1	38.9	-38.5	36.5	-33.6	34.7	-29.9	30.4	-21.4	35.2	-31.1