



VSE Project Number: U3607.0073.221

April 29, 2022

Pure Energy Solar
ATTENTION: Wayne Irwin
2121 NW 2nd St.
Gainesville, FL 32609

REFERENCE: Madero Residence: 449 Southwest Madison Court, Lake City, FL 32024
Solar Array Installation

To Whom It May Concern:

We have reviewed the existing structure at the above referenced site. The purpose of our review was to determine the adequacy of the existing structure to support the proposed installation of solar panels on the roof as shown on the panel layout plan.

Based upon our review, we conclude that the existing structure is adequate to support the proposed solar panel installation.

Design Parameters

Code: 2020 Florida Building Code - Residential, 7th Edition (2018 IRC)

Risk Category: II

Design wind speed, Vult: 118 mph (3-sec gust)

Wind exposure category: C

Connection to Roof

Mounting connection: (1) 5/16" lag screw w/ min. 2.5" threaded embedment into framing at max. 48" o.c. along rails

Install (2) rails per row of panels, evenly spaced; panel length perpendicular to the rails shall not exceed 70 in

Rail cantilever shall not exceed 33% of connection spacing

Connections shall be staggered to not overload any existing structural member

Conclusions

Based upon our review, we conclude that the existing structure is adequate to support the proposed solar panel installation. In the area of the solar array, other live loads will not be present or will be greatly reduced (2020 FBC - Residential, Section R324.4.1.1). The gravity loads, and thus the stresses of the structural elements, in the area of the solar array are either decreased or increased by no more than 5%. Therefore, the requirements of Section 807.5 of the 2020 FBC - Existing Building are met and the structure is permitted to remain unaltered.

The solar array will be flush-mounted (no more than 10" above the roof surface) and parallel to the roof surface. Thus, we conclude that any additional wind loading on the structure related to the addition of the proposed solar array is negligible. The attached calculations verify the capacity of the connections of the solar array to the existing roof against wind (uplift), the governing load case. Increases in lateral forces less than 10% are considered acceptable. Thus the existing lateral force resisting system is permitted to remain unaltered.



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Limitations

Installation of the solar panels must be performed in accordance with manufacturer recommendations. All work performed must be in accordance with accepted industry-wide methods and applicable safety standards. The contractor must notify Vector Structural Engineering, LLC should any damage, deterioration or discrepancies between the as-built condition of the structure and the condition described in this letter be found. The use of solar panel support span tables provided by others is allowed only where the building type, site conditions, site-specific design parameters, and solar panel configuration match the description of the span tables. The design of the solar panels, solar racking (mounts, rails, etc.) and electrical engineering is the responsibility of others. Waterproofing around the roof penetrations is the responsibility of others. Vector Structural Engineering assumes no responsibility for improper installation of the solar array. Vector Structural Engineering shall be notified of any changes from the approved layout prior to installation.

VECTOR STRUCTURAL ENGINEERING, LLC

FL Firm License: COA 26626



04/29/2022

Jacob Proctor, P.E.

FL License: 74277 - Expires: 02/28/2023

Project Engineer

Enclosures

JSP/bac

This item has been digitally signed and sealed by Jacob Proctor on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.



JOB NO.: U3607.0073.221
SUBJECT: WIND PRESSURE

PROJECT: Madero Residence

Components and Cladding Wind Calculations

Label: Solar Panel Array

Note: Calculations per ASCE 7-16

SITE-SPECIFIC WIND PARAMETERS:

Basic Wind Speed [mph]: 118
Exposure Category: C
Risk Category: II

Notes:

ADDITIONAL INPUT & CALCULATIONS:

Height of Roof, h [ft]:	15	(Approximate)			
Comp/Cladding Location:	Gable Roofs $20^\circ < \theta \leq 27^\circ$				
Enclosure Classification:	Enclosed Buildings				
Zone 1, 2e GCp:	1.50	Figure 30.3-2C	Zone 1, 2e γ_a :	0.77	Fig.
Zone 2n, 2r, 3e GCp:	2.43	(negative coeff.)	Zone 2n, 2r, 3e γ_a :	0.77	29.4-8
Zone 3r GCp:	2.84		Zone 3r γ_a :	0.77	
α :	9.5	Table 26.11-1			
z_g [ft]:	900	Table 26.11-1			
K_h :	0.85	Table 26.10-1			
K_e :	1.00	Table 26.9-1			
K_{zt} :	1	Equation 26.8-1			
K_d :	0.85	Table 26.6-1			
Velocity Pressure, q_h [psf]:	25.6	Equation 26.10-1			
γ_E :	1.50	Section 29.4.4			

WIND PRESSURES: Equation 29.4-7 $p = q_h (GC_p)(\gamma_E)(\gamma_a)$

Zone 1, 2e, p [psf]:	44.5	psf (1.0 W)
Zone 2n, 2r, 3e, p [psf]:	72.0	psf (1.0 W)
Zone 3r, p [psf]:	84.2	psf (1.0 W)

(a = 3 ft)



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SUBJECT: CONNECTION

PROJECT: Madero Residence

Calculate Uplift Forces on Connection

	Pressure (0.6 Dead -0.6 Wind) (psf)	Max Trib. Width ¹ (ft)	Max Trib. Area ² (ft ²)	Max Uplift Force (lbs)
Zone 1, 2e	24.9	4.0	11.7	291
Zone 2n, 2r, 3e	41.4	4.0	11.7	483
Zone 3r	48.7	4.0	11.7	569

Calculate Connection Capacity

Lag Screw Size [in]:	5/16	NDS Table 2.3.2
C _d :	1.6	
Embedment ³ [in]:	2.5	NDS Table 12.2A
Grade:	SPF (G = 0.42)	
Nominal Capacity [lbs/in]:	205	
Number of Screws:	1	
Prying Coefficient:	1.4	
Total Capacity [lbs]:	586	

Determine Result

Maximum Demand [lbs]:	569
Lag Screw Capacity [lbs]:	586

Result: **Capacity > Demand, Connection is adequate.**

Notes

1. 'Max Trib. Width' is the width along the rails tributary to the connection.
2. 'Max Trib Area' is the product of the 'Max. Trib Width' and 1/2 the panel width/height perpendicular to the rails. (2) rails per row of panels. Length of panels perpendicular to the rails shall not exceed 70".
3. Embedment is measured from the top of the framing member to the beginning of the tapered tip of the lag screw. Embedment in sheathing or other material is not effective. The length of the tapered tip is not part of the embedment length.



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SUBJECT: GRAVITY LOADS

PROJECT: Madero Residence

GRAVITY LOADS

Roof Pitch: :12

ROOF DEAD LOAD (D)	Design material weight [psf]	Increase due to pitch	Material weight [psf]
Metal Corrugated	3.4	1.12	3.0
1/2" Plywood	1.1	1.12	1.0
Framing	3.0		3.0
Insulation	0.5		0.5
1/2" Gypsum Clg.	2.2	1.12	2.0
M, E & Misc	6.5		6.5
Total Existing Roof DL	16.7		
PV Array DL	3.4	1.12	3

ROOF LIVE LOAD (Lr)

Existing Design Roof Live Load [psf]	<input type="text" value="20"/>	ASCE 7-16 Table 4.3-1
Roof Live Load With PV Array [psf]	<input type="text" value="0"/>	2020 FBC - Residential, Section R324.4.1.1



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SUBJECT: LOAD COMPARISON

PROJECT: Madero Residence

Summary of Loads

	Existing	With PV Array
D [psf]	17	20
Lr [psf]	20	0
S [psf]	0	0

Maximum Gravity Loads:

	Existing	With PV Array	
(D + Lr) / Cd [psf]	29	22	ASCE 7-16, Section 2.4.1
(D + S) / Cd [psf]	19	22	ASCE 7-16, Section 2.4.1

(Cd = Load Duration Factor = 0.9 for D, 1.15 for S, and 1.25 for Lr)

Maximum Gravity Load [psf]:	29	22
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Ratio Proposed Loading to Current Loading:

76%

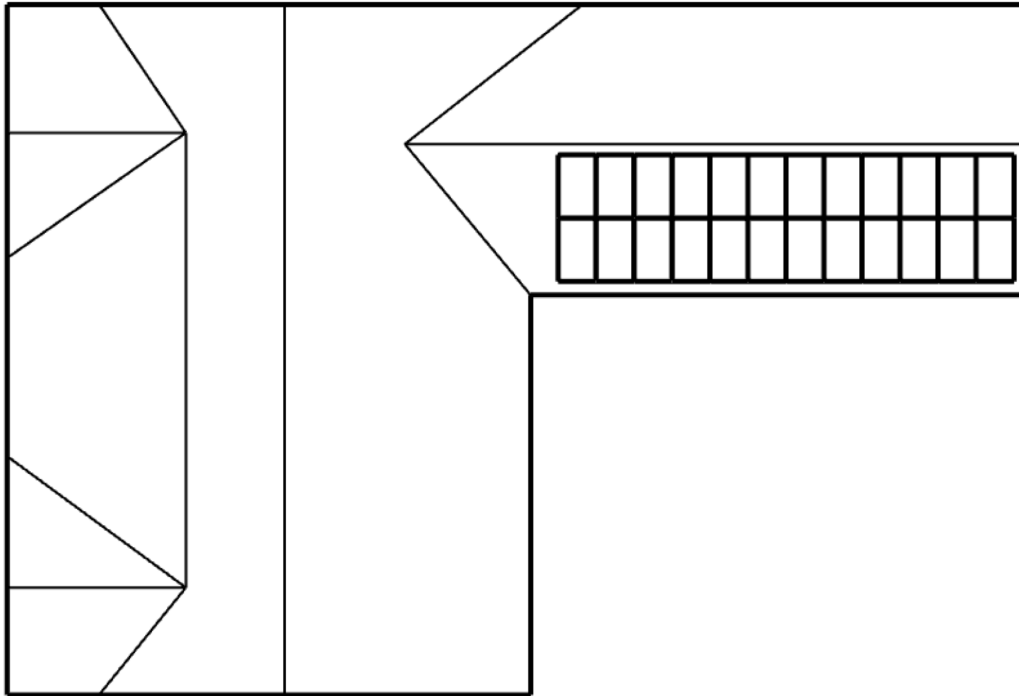
OK

The gravity loads, and thus the stresses of the structural elements, in the area of the solar array are either decreased or increased by no more than 5%. Therefore, the requirements of Section 807.5 of the 2020 FBC - Existing Building are met and the structure is permitted to remain unaltered.



JOB NO.: U3607.0073.221
SUBJECT: SOLAR LAYOUT

PROJECT: Madero Residence



Madero Layout
449 SW Madison Ct.
Lake City, FL 32024