VSE Project Number: U3607.0051.211

July 8, 2021

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

REFERENCE: Thomas Residence: 249 Southwest Oak Glen, Fort White, FL 32038
                          Solar Array Installation

To Whom It May Concern:

Per your request, 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 - Building, 7th Edition (2018 IBC)

   Risk Category: II

   Design wind speed, Vult: 121 mph (3-sec gust) per ASCE 7-16

   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
   (2) rails per row of panels, evenly spaced; panel length perpendicular to the rails not to exceed 67 in. Rail cantilever shall not exceed 50% of connection spacing.
   At flat hip framing, if occurs, reduce connection spacing listed above by 50% or see attached detail for blocking option.

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 - Building, Section 1607.12.5). 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. Because the increase in lateral forces is less than 10%, this addition meets the requirements of the exception in Section 807.5 of the 2020 FBC - Existing Building. Thus the existing lateral force resisting system is permitted to remain unaltered.

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. Connections to existing roof framing must be staggered, except at array ends, so as not to overload any existing structural member. 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 panel 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, LLC
FL Firm License: COA 26626

Coleman D Larsen
Digitally signed by Coleman D Larsen
Date: 2021.07.08 16:24:37 -06'00'
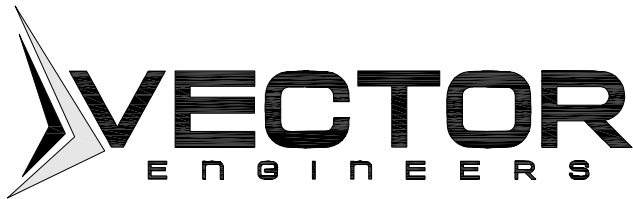
07/08/2021

_____
Coleman Larsen, P.E.
FL License: 78189 - Expires: 02/28/2023
Project Engineer

Enclosures

CDL/shs

This item has been digitally signed and sealed by Coleman Larsen 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.
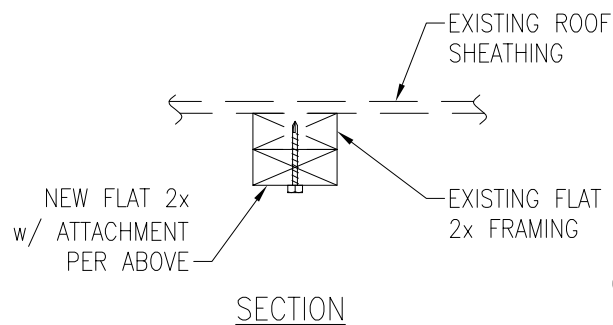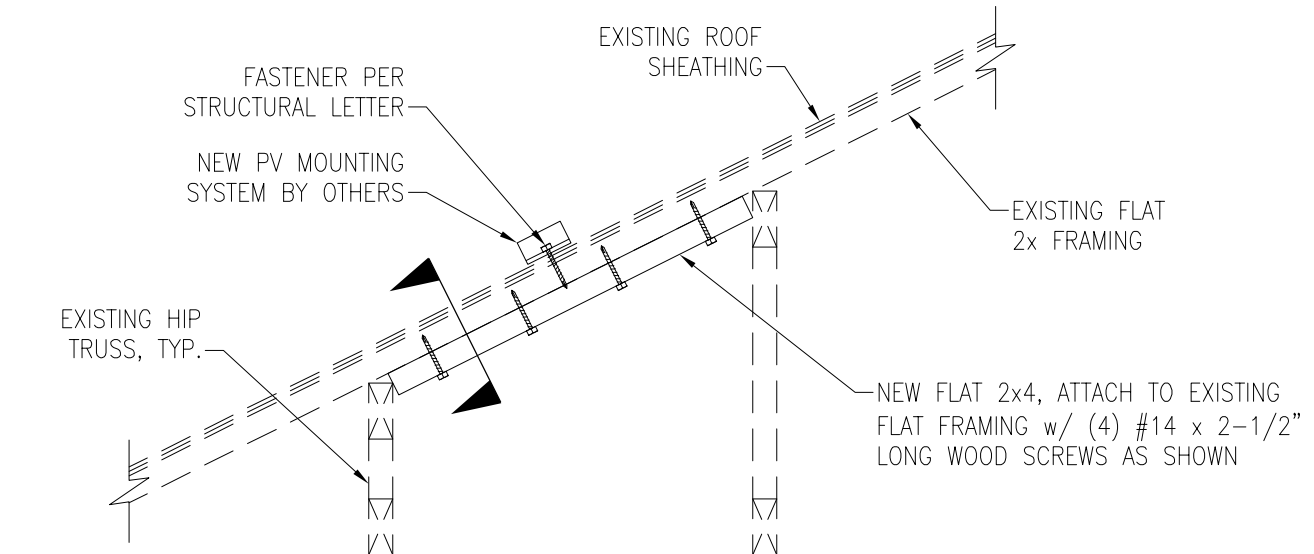
VECTOR
ENGINEERS

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SUBJECT CONNECTION @ MANUFACTURED HIP TRUSS

EXISTING ROOF SHEATHING

FASTENER PER STRUCTURAL LETTER

NEW PV MOUNTING SYSTEM BY OTHERS

EXISTING FLAT 2x FRAMING

EXISTING HIP TRUSS, TYP.

NEW FLAT 2x4, ATTACH TO EXISTING FLAT FRAMING w/ (4) #14 x 2-1/2" LONG WOOD SCREWS AS SHOWN

EXISTING ROOF SHEATHING

NEW FLAT 2x w/ ATTACHMENT PER ABOVE

EXISTING FLAT 2x FRAMING

SECTION

NOTES:
1. GRADE OF NEW DIMENSIONAL LUMBER SHALL BE SPF #2, DFL #2, OR BETTER.
2. CONSULT ENGINEER WHERE CONDITIONS DIFFER FROM THAT SHOWN.
3. RETROFIT REQUIRED @ ROOF AREAS SUPPORTING SOLAR PANELS ONLY, U.N.O. IN LETTER.

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Components and Cladding Wind Calculations

Label: Solar Panel Array   Note: Calculations per ASCE 7-16

SITE-SPECIFIC WIND PARAMETERS:

Basic Wind Speed [mph]:   121   Notes:
Exposure Category: C
Risk Category: II

ADDITIONAL INPUT & CALCULATIONS:

Height of Roof, h [ft]:   15   (Approximate)
Comp/Cladding Location: Hip Roofs 27° < θ ≤ 45°
Enclosure Classification: Enclosed Buildings

Zone 1 GC_p:	1.20	Figure 30.3-2H	Zone 1 γ_a:	0.78	Fig.
Zone 2r GC_p:	1.35	(negative coeff.)	Zone 2r γ_a:	0.78	29.4-8
Zone 2e GC_p:	1.40		Zone 2e γ_a:	0.78	
Zone 3 GC_p:	1.66		Zone 3 γ_a:	0.78	

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]:	27.0	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, p [psf]:	37.8	psf (1.0 W)
Zone 2r, p [psf]:	42.8	psf (1.0 W)
Zone 2e, p [psf]:	44.3	psf (1.0 W)
Zone 3, p [psf]:	52.4	psf (1.0 W)

(a = 3 ft)

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Calculate Uplift Forces on Connection

	Pressure (0.6 Dead -0.6 Wind) (psf)	Max Trib. Width[1] (ft)	Max Trib. Area[2] (ft²)	Max Uplift Force (lbs)
Zone 1	20.9	4.0	11.2	233
Zone 2r	23.9	4.0	11.2	266
Zone 2e	24.8	4.0	11.2	277
Zone 3	29.6	4.0	11.2	331

Calculate Connection Capacity

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

Determine Result

Maximum Demand [lbs]:	331
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 67".

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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GRAVITY LOADS   Roof Pitch: | 7.0 | :12

ROOF DEAD LOAD (D)	Design material weight [psf]	Increase due to pitch	Material weight [psf]
Asphalt Shingles	2.3	1.16	2.0
1/2" Plywood	1.2	1.16	1.0
Framing	3.0		3.0
Insulation	0.5		0.5
1/2" Gypsum Clg.	2.3	1.16	2.0
M, E & Misc	1.5		1.5
Total Existing Roof DL	10.8		
PV Array DL	3.5	1.16	3

ROOF LIVE LOAD (Lr)

Existing Design Roof Live Load [psf]	20	ASCE 7-16 Table 4.3-1
Roof Live Load With PV Array [psf]	0	2020 FBC - Building, Section 1607.12.5

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Summary of Loads

	Existing	With PV Array
D [psf]	11	14
Lr [psf]	20	0
S [psf]	0	0

Maximum Gravity Loads:

	Existing	With PV Array	
(D + Lr) / Cd [psf]	25	16	ASCE 7-16, Section 2.4.1
(D + S) / Cd [psf]	12	16	ASCE 7-16, Section 2.4.1

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

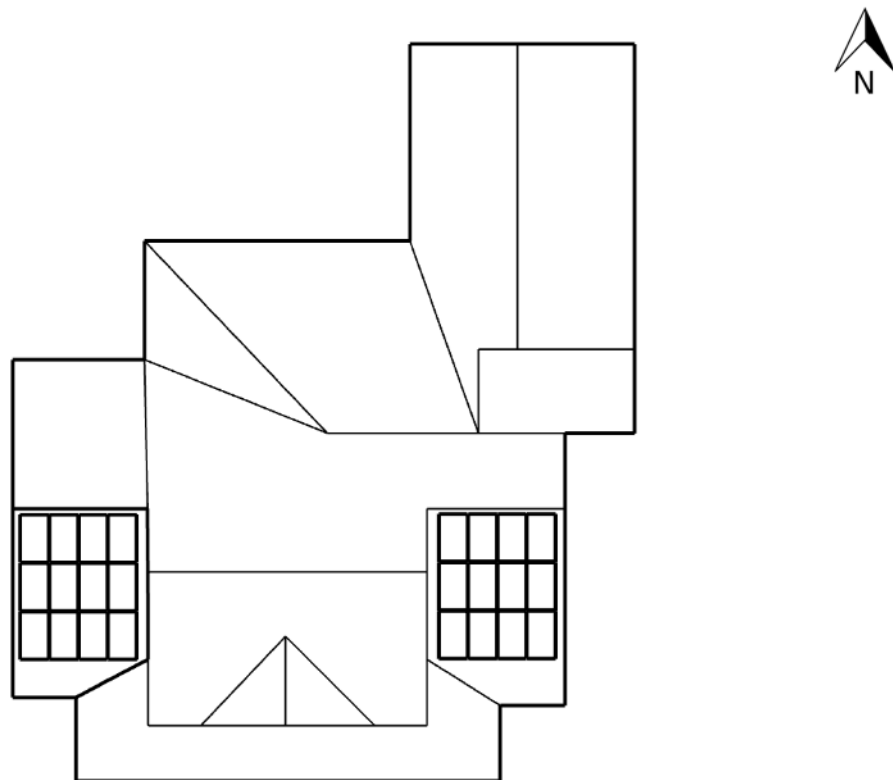| Maximum Gravity Load [psf]:	25	16

Ratio Proposed Loading to Current Loading: **64%** 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.

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