



VSE Project Number: U3607.0064.221

February 8, 2022

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

REFERENCE: Stephenson Residence: 3951 Northwest Noegel Road, Wellborn, FL 32094
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 - Residential, 7th Edition (2018 IRC)

Risk Category: II

Design wind speed, Vult: 117 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 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 - 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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Stephenson Residence

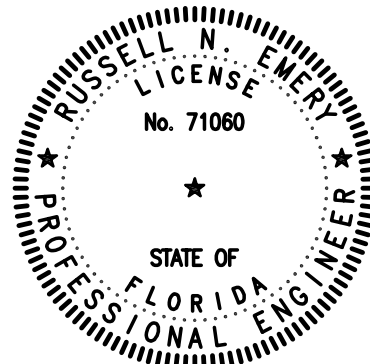
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Limitations

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. 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 shall be notified of any changes from the approved layout prior to installation.

VECTOR STRUCTURAL ENGINEERING, LLC

FL Firm License: COA 26626



02/08/2022

Russell Emery, P.E.

FL License: 71060 - Expires: 02/28/2023

Project Engineer

Enclosures

RNE/amr

This item has been digitally signed and sealed by Russell N. Emery 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.



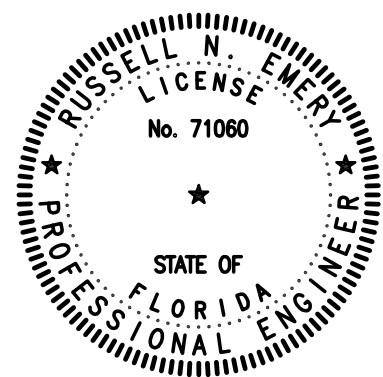
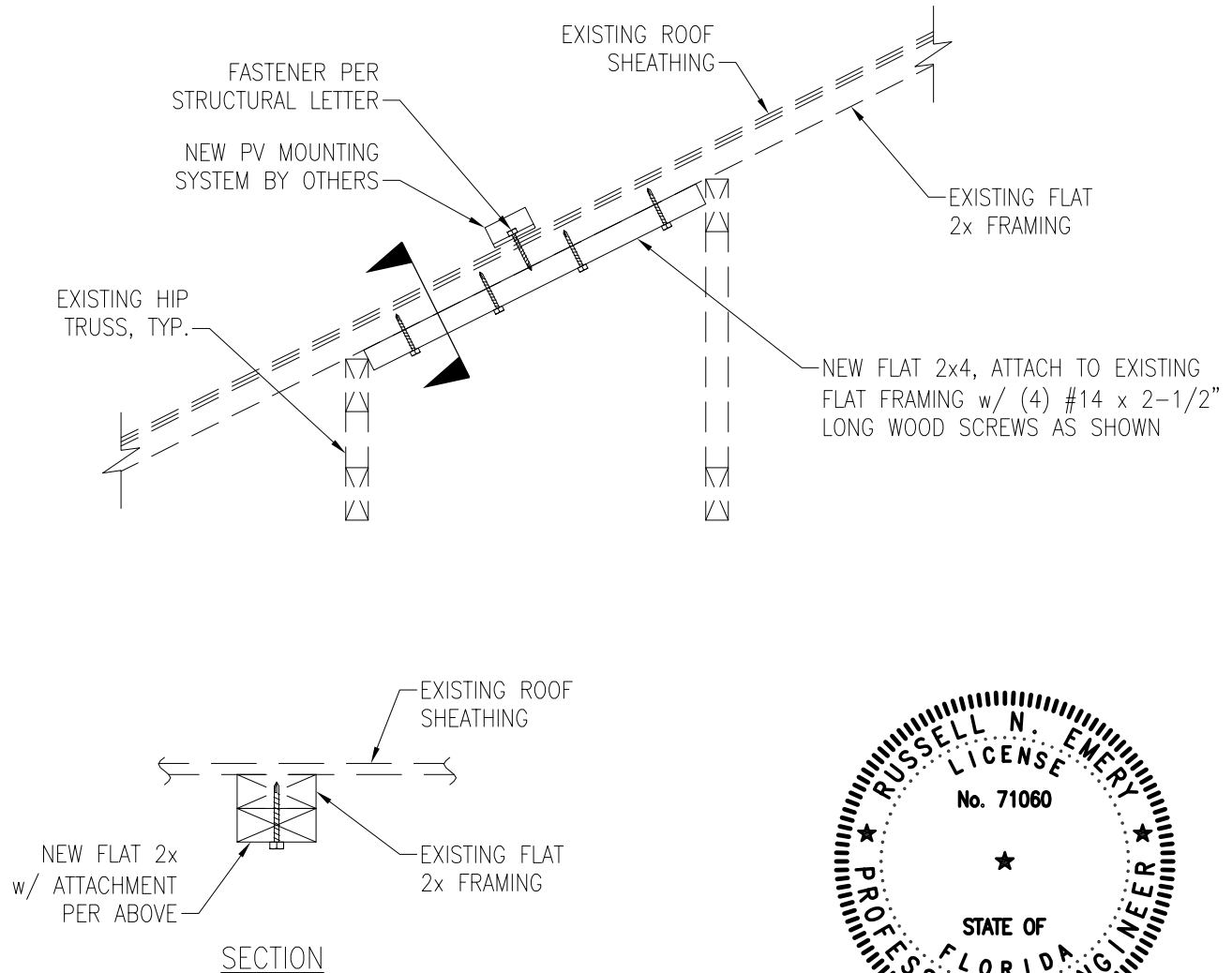
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SUBJECT CONNECTION @ MANUFACTURED HIP TRUSS



02/08/2022

This item has been digitally signed and sealed by Russell N. Emery 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.

NOTES:

1. GRADE OF NEW DIMENSIONAL LUMBER SHALL BE SPF OR BETTER
2. THIS DETAIL IS PROVIDED AS AN OPTION IF FLAT TRUSS FRAMING OCCURS AS PART OF THE HIP PACKAGE. IF FLAT FRAMING DOES NOT OCCUR, OR IF THE PANELS DO NOT OCCUR OVER THE FLAT FRAMING, THIS DETAIL IS NOT APPLICABLE AND NOT REQUIRED. ALTERNATIVE TO THIS DETAIL, SPACING MAY BE REDUCED BY 50% FOR CONNECTION TO FLAT TRUSS FRAMING.



JOB NO.: U3607.0064.221
SUBJECT: WIND PRESSURE

PROJECT: Stephenson Residence

Components and Cladding Wind Calculations

Label: Solar Panel Array

Note: Calculations per ASCE 7-16

SITE-SPECIFIC WIND PARAMETERS:

Basic Wind Speed [mph]: 117
Exposure Category: C
Risk Category: II

Notes:

ADDITIONAL INPUT & CALCULATIONS:

Height of Roof, h [ft]: 15 (Approximate)
Comp/Cladding Location: Hip Roofs $20^\circ < \theta \leq 27^\circ$
Enclosure Classification: Enclosed Buildings
Zone 1 GCp: 1.36 Figure 30.3-2G Zone 1 γ_a : 0.77 Fig.
Zone 2e, 2r, 3 GCp: 1.95 (negative coeff.) Zone 2e, 2r, 3 γ_a : 0.77 29.4-8

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 : 0.99 Table 26.9-1
 K_{zt} : 1 Equation 26.8-1
 K_d : 0.85 Table 26.6-1
Velocity Pressure, q_h [psf]: 25.1 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]: 39.6 psf (1.0 W)
Zone 2e, 2r, 3, p [psf]: 56.8 psf (1.0 W)

(a = 3 ft)



JOB NO.: U3607.0064.221
SUBJECT: CONNECTION

PROJECT: Stephenson 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	22.0	4.0	11.7	256
Zone 2e, 2r, 3	32.3	4.0	11.7	376

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]:	376
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.



JOB NO.: U3607.0064.221
SUBJECT: GRAVITY LOADS

PROJECT: Stephenson Residence

GRAVITY LOADS

Roof Pitch: :12

ROOF DEAD LOAD (D)	Design material weight [psf]	Increase due to pitch	Material weight [psf]
Asphalt Shingles	2.2	1.08	2.0
1/2" Plywood	1.1	1.08	1.0
Framing	3.0		3.0
Insulation	0.5		0.5
1/2" Gypsum Clg.	2.2	1.08	2.0
M, E & Misc	1.5		1.5
Total Existing Roof DL	10.4		
PV Array DL	3.3	1.08	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



JOB NO.: U3607.0064.221
SUBJECT: LOAD COMPARISON

PROJECT: Stephenson Residence

Summary of Loads

	Existing	With PV Array
D [psf]	10	14
Lr [psf]	20	0
S [psf]	0	0

Maximum Gravity Loads:

	Existing	With PV Array	
(D + Lr) / Cd [psf]	24	15	ASCE 7-16, Section 2.4.1
(D + S) / Cd [psf]	12	15	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]:	24	15
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Ratio Proposed Loading to Current Loading:

62%

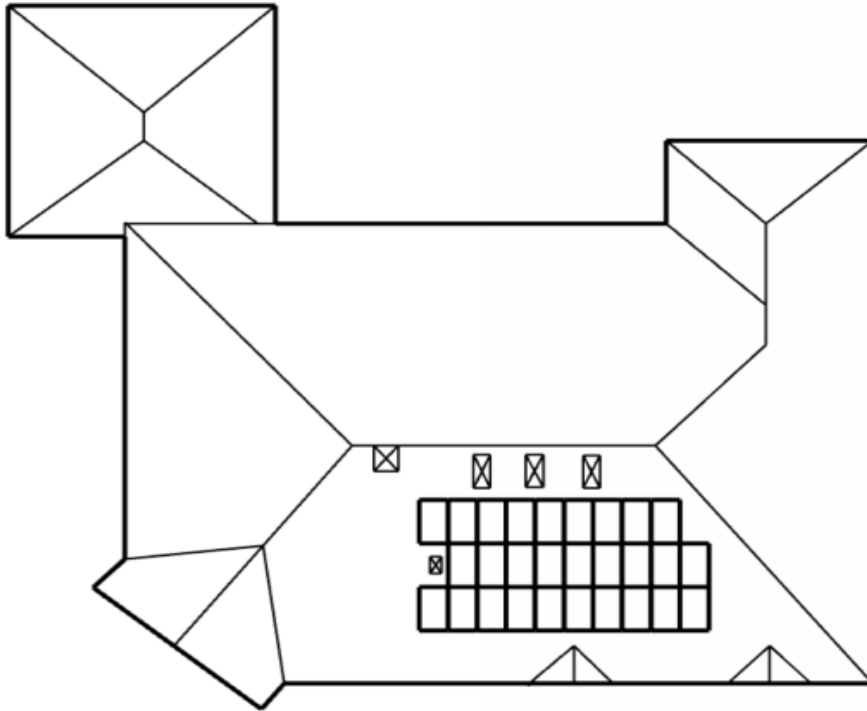
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The gravity loads, and thus the stresses of the structural elements, in the area of the solar array are either decreased or increased by no more than 5%. Therefore, the requirements of Section 807.5 of the 2020 FBC - Existing Building are met and the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



JOB NO.: U3607.0064.221
SUBJECT: SOLAR LAYOUT

PROJECT: Stephenson Residence



Stephenson Layout
3951 NW Noegel Rd.
Welborn, FL 32094