5/23/2022

**RE: Structural Certification for Installation of Residential Solar**
**ERNEST PASQUOT:18011 US-441, LAKE CITY, FL 32024**

Attn: To Whom It May Concern

This Letter is for the existing roof framing which supports the new PV modules as well as the attachment of the PV system to existing roof framing. From the field observation report, the roof is made of Metal roofing over 1/2 inch plywood supported by 2X4 Trusses at 24 inches .The slope of the roof was approximated to be 7,18,23 and 43 degrees and having an allowable maximum chord span of 6 feet between supports.

After review of the field observation data and based on our structural capacity calculation, **the existing roof framing has been determined to be adequate to support the imposed loads without structural upgrades.** Contractor shall verify that existing framing is consistent with the described above before install. Should they find any discrepancies, a written approval from SEOR is mandatory before proceeding with install. Capacity calculations were done in accordance with applicable building codes.

| | | | | | |
|---|---|---|---|---|---|
| Code | 2020 Florida Building Code (ASCE 7-16) | | | | |
| Risk category | | II | Wind Load | (component and Cladding) | |
| Roof Dead Load | Dr | 10 psf | | V | 140 mph |
| PV Dead Load | DPV | 3 psf | | Exposure | B |
| Roof Live Load | Lr | 20 psf | | | |
| Ground Snow | S | 0 psf | | | |

If you have any questions on the above, please do not hesitate to call.

Sincerely,

Vincent Mwumvaneza, P.E
EV Engineering LLC
276-220-0064/951-355-3348

VINCENT MWUMVANEZA LICENSE No. 86986 STATE OF FLORIDA PROFESSIONAL ENGINEER
Exp:02/28/2023
STRUCTURAL ONLY

This item has been electronically signed and sealed by Vincent Mwumvaneza using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Vincent Mwumvaneza
Date: 2022.05.23 19:20:23 -04'00'

# Structural Letter for PV Installation

Date: 5/23/2022
Job Address: **18011 US-441**
**LAKE CITY, FL 32024**
Job Name: **ERNEST PASQUOT**
Job Number: **220523EP**

## Scope of Work

This Letter is for the existing roof framing which supports the new PV modules as well as the attachment of the PV system to existing roof framing. All PV mounting equipment shall be designed and installed per manufacturer's approved installation specifications.

## Table of Content



## Engineering Calculations Summary

| | | | |
|---|---|---|---|
| Code | 2020 Florida Building Code (ASCE 7-16) | | |
| Risk category | | II | |
| Roof Dead Load | Dr | 10 | psf |
| PV Dead Load | DPV | 3 | psf |
| Roof Live Load | Lr | 20 | psf |
| Ground Snow | S | 0 | psf |
| Wind Load | (component and Cladding) | | |
| | V | 140 | mph |
| | Exposure | B | |

## References

NDS for Wood Construction

Sincerely,


Vincent Mwumvaneza, P.E
EV Engineering LLC
276-220-0064/951-355-3348


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Date: 2022.05.23 19:20:33 -04'00'

## Wind Load Cont.

| | | | |
|---|---|---|---|
| Risk Category = | II | | |
| V= | 140 | mph | **ASCE 7-16 Figure 26.5-1B** |
| Exposure = | B | | |
| $K_{Zt}$ = | 1.0 | | ASCE 7-16 Sec 26.8.2 |
| $K_Z$ = | 0.57 | | ASCE 7-16 Table 26.10-1 |
| $K_d$ = | 0.85 | | ASCE 7-16 Table 26.6-1 |
| $K_e$ = | 1.00 | | ASCE 7-16 Table 26.9-1 |
| $q_h = 0.00256K_zK_{zt}K_dK_eV^2$ = | 24.21 | psf | |
| Pitch = | 7.0 | Degrees | |
| $\gamma_E$ = | 1.5 | Conservatively assuming all exposed | |
| $\gamma_a$ = | 0.8 | conservatively assuming 10 $ft^2$ effective area | |

| **Uplift (W)** | | **Zone(1')** | **Zone(1)** | **Zone(2)** | **Zone(3)** |
|---|---|---|---|---|---|
| **Fig. 30-3-2** | $GC_p$= | -0.9 | -1.4 | -1.9 | -2.4 |
| **Eq. 29.4-7** | $P=q_h(GC_p)(\gamma_E)(\gamma_a)$= | -26.15 | -40.67 | -55.20 | -69.73 |

| | | |
|---|---|---|
| $GC_p$= | 0.3 | Figure 30.3-2 |
| $P=q_h(GC_p)(\gamma_E)(\gamma_a)$= | 8.72 | Equation 29.4-7 |

**Rafter Attachments: 0.6D+0.6W (CD=1.6)**

**Connection Check**

| | | | |
|---|---|---|---|
| Attachement max. spacing= | 4 | ft | |
| S-5 Ultimate Withdrawal Value)= | 900 | lbs | Manufacturer Test |
| Safety Factor | 3 | | |
| Allowable Capacity= | 300 | lbs | |

| **Zone** | **Average Trib Width** | **Area (ft)** | **Uplift (lbs)** | **Down (lbs)** |
|---|---|---|---|---|
| **Zone(1')** | 4 | 11.0 | 106.0 | 71.0 |
| **Zone(1)** | 4 | 11.0 | 158.8 | 71.0 |
| **Zone(2)** | 4 | 11.0 | 211.7 | 71.0 |
| **Zone(3)** | 4 | 11.0 | 264.5 | 71.0 |

**Conservative Max=** 264.5 < 300

**CONNECTION IS OK**

1. Pv seismic dead weight is negligible to result in significant seismic uplift, therefore the wind uplift governs
2. Embedment is measured from the top of the framing member to the tapered tip of a lag screw. Embedment in sheading or other material does not count.

EV ENGINEERING

## Vertical Load Resisting System Design

### Trusses

| | | | |
|---|---|---|---|
| **Max Length, L =** | **6.0** ft | (Beam maximum Allowable Horizontal Span) | |
| **Tributary Width, $W_T$ =** | **24** in | | |
| **Dr =** | **10** psf | 20 plf | |
| $L_r$ = | 20 psf | | |
| **$W_{down}$=** | 8.72 psf | 17.4 plf | |
| **Pv=** | **3 psf** | 6 plf | |

**Load Case: DL+0.6W (CD=1.6)**

| | | | |
|---|---|---|---|
| Pv max Shear= | 71.0 lbs | | |
| Max Moment, $M_u$ = | 109 lb-ft | Conservative | |
| Max Shear, $V_u$=wL/2+Pv Point Load = | 149 lb | | |

**Note: Proposed loading will add less than 5% of the existing loads.**

**Member Capacity**

DF-L No.2

| 2X4 | Design Value | $C_L$ | $C_F$ | $C_i$ | $C_r$ | $K_F$ | ϕ | λ | Adjusted Value |
|---|---|---|---|---|---|---|---|---|---|
| $F_b$ = | 900 psi | 1.0 | 1.5 | 1.0 | 1.15 | 2.54 | 0.85 | 0.8 | 1553 psi |
| $F_v$ = | 180 psi | N/A | N/A | 1.0 | N/A | 2.88 | 0.75 | 0.8 | 180 psi |
| E = | 1600000 psi | N/A | N/A | 1.0 | N/A | N/A | N/A | N/A | psi |
| $E_{min}$ = | 580000 psi | N/A | N/A | 1.0 | N/A | 1.76 | 0.85 | N/A | 580000 psi |

| | | | | | |
|---|---|---|---|---|---|
| Depth, d = | 3.5 in | | | | |
| Width, b = | 1.5 in | | | | |
| Cross-Sectonal Area, A = | 5.25 $in^2$ | | | | |
| Moment of Inertia, $I_{xx}$ = | 5.35938 $in^4$ | | | | |
| Section Modulus, $S_{xx}$ = | 3.0625 $in^3$ | | | | |
| Allowable Moment, $M_{all} = F_b'S_{xx}$ = | 396.2 lb-ft | DCR=$M_u/M_{all}$ = | 0.17 < 1 | **Satisfactory** | |
| Allowable Shear, $V_{all} = 2/3F_v'A$ = | 630.0 lb | DCR=$V_u/V_{all}$ = | 0.24 < 1 | **Satisfactory** | |

**Siesmic Loads Check**

| | | |
|---|---|---|
| Roof Dead Load | 10 | psf |
| % or Roof with Pv | 52.8% | |
| Dpv and Racking | 3 | psf |
| Average Total Dead Load | 11.6 | psf |
| Increase in Dead Load | 7.9% | **OK** |

The increase in seismic Dead weight as a result of the solar system is less than 10% of the existing structure and therefore no further seismic analysis is required.

**Limits of Scope of Work and Liability**

We have based our structural capacity determination on information in pictures and a drawing set titled PV plans - ERNEST PASQUOT. The analysis was according to applicable building codes, professional engineering and design experience, opinions and judgments. The calculations produced for this dwelling's assessment are only for the proposed solar panel installation referenced in the stamped plan set and were made according to generally recognized structural analysis standards and procedures.