

## Roof Assessment for Solar Panel Post Installation

**Date:** September 13, 2021  
**Prepared for:** C&S Lilly 24pR  
**Project Number:** 210559  
**Assessment Date:** September 13, 2021  
**Site Address:** 3641 Rawls Church Rd Fuquay-Varina NC 27526  
**Purpose:** Structural Roof Assessment for installation of 24 panel solar array.  
**Prepared by:** Landon Wilson & Clay Medlin, PE, NC #048735  
**NC COL:** C-3298, CDR & Assoc., Inc.



CDR & Assoc., Inc. thanks you for the opportunity to provide you with a letter for the inspection of the roof framing for the installation of solar panel system on the roof of the foresaid property hereafter referred to as "house". All references to directions or locations indicated in this report are by facing the front of the house.

### **Observations and Analysis of Roof**

- **Basis of Evaluation:** The engineering analysis is based on measurements and photographs taken onsite by CDR+A technician, Brady Jarvis.
- **Roof Construction:** A asphalt shingles roof over wood decking on 2x8 rafters at 16" o.c.
- **Roof Pitch:** Multiple pitches
- **Solar Panel Array:** 24 panels.
- **Total Array Square Footage:** The panels are approximately 39.37" x 64.57" or 17.65 sf each, round up to 18 sf x 24 panels = total surface area of 432 sf.
- **Total weight of Array:** Panel weighs approximately 40 lbs. ea. X 24 = 960 lbs. for the Array.
- **Total Additional Weight on Roof:** 960 lbs / 432 sf = 2.22 psf add for rail mount system, assume 3 psf additional load on roof structure.
- **Rail Mount System:** The panels are mounted on aluminum rails at top and bottom of the panels for each row of panels.

- **Analysis of Roof Structure:**

- Additional dead load 15 psf (12 psf from roof + 3 psf for panels)
  - Roof Live Load - 20 psf. (Allowable Residential Code w/o reductions)
  - The 2x8 SYP Rafters spaced 16" apart were analyzed (worst case).
  - Roof Pitch 9.8/12
  - The maximum unbraced span: 14' 5" measured horizontal.
  - Analysis with the additional roof load determined that the roof Rafters are 88% stressed. The Rafters are in compliance with the current Residential Building Code.
- **Wind Speed:** Components and cladding 116 mph wind load uplift of -30 psf.
  - **Total Wind Load Uplift:** -30 psf x 432 sf = 12,960 lbs total uplift for solar array.
  - **Number of Attachment Anchors:** Use a minimum of two (2) bracket per panel (one top and bottom) or less to meet rail manufacturers recommended support needs = 48 total attachment brackets.
  - **Wind Load Uplift per Anchor:** 12,960 lbs total uplift / 48 = 270 lbs for solar array.
  - **Strength of Hold-down Anchors:** Pegasus Solar® L-Foot the SunPower InvisiMount is reported to be used with the Pegasus Solar L-Foot. The L-Foot is attached directly into the top of the rafter members with 5/16" stainless steel lag screw with at least 3" of embedment into the wood member. The load testing results determined an average pullout failure load of 556 lbs per screw, exceeding the required 270 lbs per anchor. The loading proposed creates a safety factor of 2.05 or greater for the attachment.

### **Conclusions & Recommendations**

By analysis it was determined that the roof rafter members were adequate for the addition load of the solar panel array.

The installation of the solar panel array using the Pegasus Solar® L-Foot attachment bracket directly to the top of the wood members with one 5/16" stainless steel lag screw per manufacturers spec. is adequate for the loads imposed on them.

**Based on the information provided by Mr. Alex Nelson the solar array appeared to have been installed in accordance with the original report. We are not recommending any remediation at this time.**

### **Closure**

We appreciate the opportunity to provide structural assessment services to you. Please contact us should you have any questions.

Sincerely,

CDR+A Structural Engineers