La Luz Engineering, PLLC

March 21, 2023

SolarTyme
6710 Jefferson Davis Hwy
Richmond, VA 23237

Re: **Structural Review of Existing Roof for New Photovoltaic Panel Installation**
Potter Residence – 254 Docs Road, Lillington, NC 27546

Per your request, we have reviewed the existing roof framing which will receive new solar panel arrays for this project. This review was performed in accordance with the provisions of the 2018 North Carolina Residential Code, 2018 Virginia Existing Building Code and American Wood Council National Design Specification (NDS) for Wood Construction. Moreover, the review evaluates the ability of the existing structure to handle gravitational loads and wind uplift loads from the addition of the proposed PV system. The calculations on the following pages detail the modifications to gravitational loading and wind uplift respectively.

The existing roof framing members are 2" x 4" wood trusses at " on center. The roofing material is metal. There are thirty-six 440 W photovoltaic modules which will be installed on the roof of this residence. Ironridge railing will be used for this project.

Per the ASD load calculations section of the calculations below, the PV system installation results in a decrease in loading to the existing roof structure.   Based on this analysis the roof framing was found to adequately support the proposed PV system. Additional rafters will be installed as part of this project.

The proposed PV system roof attachments are S-5! Corrubrackets at a 48" maximum attachment spacing. The calculations in the *Uplift Capacity* section of the calculations demonstrate the brackets will provide adequate resistance to uplift based on manufacturer's test results.

Structural analysis of the entire structure was not completed, and we are not the original Engineer of Record for this residence. We did not inspect the residence and all roof framing dimensions are based on the contractor's site analysis and plan drawings. Our structural review was limited to analyzing the existing structural roof members for the addition of the photovoltaic panels, based on our understanding of the existing residence, as described above. The truss connections have not been reviewed and the type and quality of wood used for construction is unknown. We are also not the Engineer of Record for the solar hardware, connections or layout. La Luz Engineering does not assume responsibility for improper installation of any solar hardware.

Regards,

La Luz Engineering, PLLC

Ben Brokaw, P.E.
Principal

3/21/2023

La Luz Engineering, PLLC   12201 Tamarac Trail NE Albuquerque NM 87111   505-459-9224
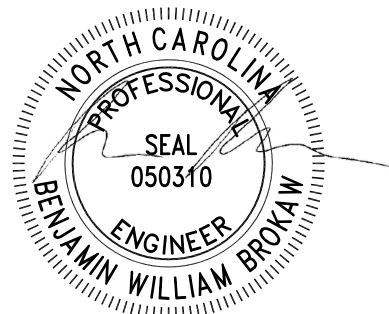
Site Information

Wind	117 mph
Exposure	C
Lumber	Southern Pine
Grade	No. 1
Modulus of Elasticity	1,400,000

Panel Information

Panel Type	Emmvee440W
Panel Length	75.3 in
Panel Width	44.6 in
Panel Weight	53.1 lbs

Roof Material	Metal	
Roof Dead Load	$Q_D =$	8 psf
PV System Dead Load	$Q_{PV} =$	3 psf
Framing Spacing	$s_{roof} =$	24 in

Gravitational Loading (VEBC Section 603.7.3)

*R324.4.1 - 2015 VRC

Existing Live Load	$LL_E =$	20 psf	Table 1607.1
Existing Snow Load	$SL_E =$	10 psf	
Existing Roof Dead Load	$DL_E =$	8 psf	
Installed PV System Live Load	$LL_{pv} =$	0 psf	
Installed PV System Snow Load	$SL_{pv} =$	7 psf	Reduced due to slope
Installed PV System Total Dead Load	$DL_{pv} =$	11 psf	& unobstructred slippery surface

ASD Load Combinations	Existing	Installed PV
DL	8 psf	11 psf
DL + LL	28 psf	11 psf
DL + SL	18 psf	18 psf
DL + .75LL + .75SL	31 psf	17 psf

Maximum Existing Load M_{el} 31 psf

Maximum Installed PV System Load M_{I} 18 psf

$$\mathbf{M_{el}} \quad > \quad \mathbf{M_{pv}} \quad \{OK\}$$

Uplift Demand / Lag Screw Check

Mean Roof Height	<	30
Exposure		C
Height & Exposure Adjustment Coefficient		1.20 Table R301.2(3)
Effective Wind Area		10 ft^2
*Design Wind Pressure (*Zone 3 most conservative value)*	p =	-33.00 Table R301.2(2)
Trib. Depth for Each Rail	$d_{pv} = L/2 =$	3.3 ft
Trib. Depth for Each Rail	$b_{pv} = W/2 =$	1.70 ft
Screw Anchor Spacing	$S_{pv} =$	4 ft (max)
Uplift Force on Each Screw, Portrait	$U_L = (p + Q_{pv}) * d_{pv} * s_{pv} =$	-412.4 lbs (Upwards)
Uplift Force on Each Screw, Landscape	$U_w = (p + Q_{pv}) * b_{pv} * s_{pv} =$	-204.5 lbs (Upwards)

Design Uplift Force $P_{uplift} = 0.6*[Max\ (\ U_L\ ,\ U_W)] =$ **-247.44** lbs (Upwards)

Uplift Capacity

Assume McElroy Metal Maxima Panels

     S-5! Bracket Allowable Load S_{ALL} 580 lbs

     S-5! Safety Factor S_{fact} 2

$$\mathbf{S_{All}} \quad > \quad \mathbf{P_{uplift}} \quad \{OK\}$$